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THE INTERNATIONAL HYGIENE EXHIBITION AT DRESDEN

By Dr. HENRY G. BEYER

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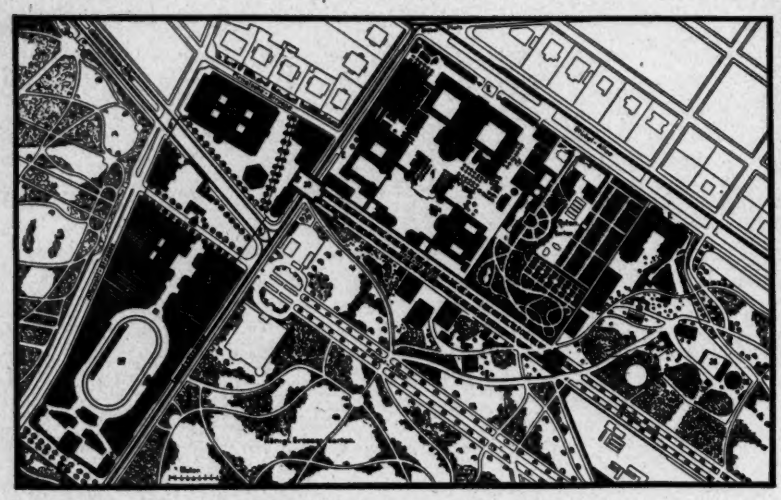
THE "Internationale Hygiene Ausstellung, Dresden, 1911," has by this time closed its doors and passed into history. It was one of those rare and remarkable creations of the human mind that will absolutely refuse to die. The exposition itself was only the opening scene in a performance which had its beginning in the month of May and ended with a climax in the month of October, when the curtain dropped. Its real work, though impressive and monumental from the start, has only just begun. Little folks and little minds may criticize the little imperfections about it from a distance. Those who are in the habit of looking for principles in things with broad and generous minds, having taken the trouble to visit and study the exposition more conscientiously, were overwhelmed with its grandeur, its beauty and the nobility of the motives underlying the undertaking. Fortunate indeed are those who were allowed to witness the great event, still more fortunate those who may count themselves active participants in it. For, nothing, no event in history, could be cited as showing the working of the human mind in the Germanic race of man, as illustrating it in all its splendid attributes and as placing it in a clearer light, to better advantage, than did this magnificent hygienic exposition. No other human endeavor could be cited as showing the ultimate motive power in the accumulation of personal wealth to be, in reality, that of aquiring the ability and power of giving to others and of, thus, contributing to the happiness of others, than did this exposition. As an organized endeavor to prevent sickness and prolong human life, to project the living laws of health and happiness into the minds, the hearts and the very homes of people, it certainly surpassed anything of the kind in the whole history of hygiene and sanitation.



GROUND PLAN OF THE EXPOSITION.

There is not a single visitor who does not regret the shortness of the existence of this great exposition; who did not feel his interest in it increasing daily, while in attendance; who would not welcome an opportunity of returning to it for more instruction and inspiration; who was not moved to wish that every living man and woman might receive the benefits this exposition was intended to convey and to disseminate.

All expositions are schools of learning of the most practical sort. International expositions are the universities in which the different nations teach each other. The exhibits, carefully selected and arranged in groups, represent the achievements of many years, the results of many years of study and labor, in a predigested form and ready to enter the understanding without requiring any effort on the part of the observer, except that he be in a receptive mood. There was a time when the attributes of usefulness on the part of the high arts and sciences were regarded as detracting from their value; when the beauty of an object was thought to end where its usefulness began; when sciences, we were told, had a right to exist for their own sake and regardless of their usefulness to mankind. Human physiology itself, during its juvenile development in recent years, had become so precociously independent as to barely recognize its ancient relationship to mother Medicine. What a remarkable change of front in this general attitude has been made in a few years, was perhaps never better shown nor more efficiently demonstrated than in the "Internationale Hygiene Exposition, Dresden, 1911," where one great, intelligent, strong mind succeeded in gently pressing the fruits of every known art, science and industry into the service of humanity. Disciplined, orderly cooperation toward one common and useful end and purpose was never and nowhere shown to better advantage than in the work of organizing, creating and

conducting to a successful termination this truly great exposition. By no means the least that can be said of it is that it proved to be a financial as well as a scientific and philanthropic success.

A General View of the Exposition Grounds

The exposition grounds cover in all an area of 320,000 square meters, of which 70,000 square meters are occupied by buildings, 72 in all, large and small. This immense area was contributed partly by the "Grosse Garten," partly by the Royal Botanical Garden, the park of Price John George and the Dresden Commons. The Lenné-Strasse, dividing this area, was bridged over. One of the first serious difficulties in planning with which the Dresden architects were confronted was to so distribute their buildings that the large fine old linden trees in these various parks should not be damaged. This difficulty they succeeded in overcoming to perfection. They distributed the various buildings in such a manner as to make the trees serve as a rich green background for them, thus, at the same time, avoiding rigid geometrical lines and producing, instead, a most picturesque effect.

The main entrance to the grounds consists of three rows of large and imposing columns, covered in above. Passing through these columns, and to the right of the main entrance we find the administration building which houses the various offices of the director, assistant directors, the post offices, the fire department and the sanitary and red-cross companies, all excellently and most efficiently organized; to the left stands a very large structure containing the assembly hall, intended for the meetings for the large number of congresses that met in Dresden during the summer, the various exposition halls for school hygiene and the care of children, exhibition rooms for dental hygiene, tropical hygiene and chemical industries, for infectious and venereal diseases.

Main Entrance from within.

From the enclosed oblong square, the visitor overlooks a larger open space and notices in the distance the imposing structure devoted to popular hygiene which is marked above the entrance in large and imposing letters, "Der Mensch." This imposing structure has a prominent, semicircular entrance, divided by a series of large columns, 11 meters high, surmounted by a cupola and leading into a spacious vestibule, on either side of which are wardrobes, and, finally, into a magnificent hall, with a stage or podium at its furthest end for giving seating capacity to the officers conducting various meetings, with their guests of honor. Against the background of this stage there is visible a large statue with the inscription "No Wealth is equal to thee, O Health!" This entire building is devoted to popular hygiene. Passing down the wide steps of the first open square, we find ourselves entering a large open enclosure in the grounds. This is the so-called "Festplatz." On the sides of this Festplatz are various small stores, a

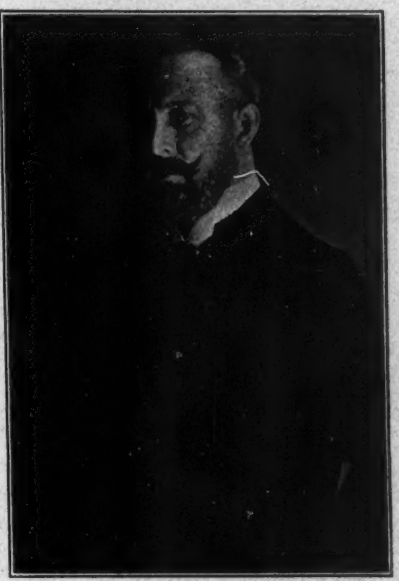
MAIN COURT OF THE EXHIBITION.

music pavilion, garden restaurant, to the right a wine restaurant with a terrace above and the recently erected pavilion of Great Britain. Farther to the left and overlooking the garden restaurant there is the permanent exhibition building of Dresden, artistically embedded among the new buildings. On the left, also, and against the botanical garden we find the recreation park. This park is occupied by a very original Bavarian restaurant, a hippodrome, a place for dancing, an academic *Beer-kneipe,* Japanese and Indian tea-houses. This recreation park proved a great necessity in that it accommodated the overflow of sightseers and gave them a chance to rest and refresh themselves, lending at the same time variety to scenery and interest to sightseers, without interfering with the intended serious character of the exposition.

The city exposition palace, Steinpalast, forms the center of the exposition; this palace had to undergo extensive interior changes to accommodate the historical and ethnological sections, some of the most remarkable features of the whole exposition. While exhibiting most effectually the contrast between past and present conditions as regards hygiene, it also showed and illustrated what we hear so often without

attaching any profound meaning to it, namely, that there is nothing new under the sun, and what we call new, in reality, embodies an old and identical idea in a new garb.

Connected with the Steinpalast by large halls is the "Hall for Chemical Industry" and scientific instruments. To the right of the large "Festplatz" and between it and the "Grosse Garten" and amidst a long row of fine large linden trees, there runs along an avenue, 40 meters wide, along one of the sides of which foreign nations have erected their pavilions. China has erected a pavilion in the form of a pagoda. Austria has built a large-sized rectangular structure with a massive roof, high walls, large windows and wide imposing entrances. Russia has erected a building after designs made by a Russian architect and resembling in style some of the buildings seen in the Kremelin.

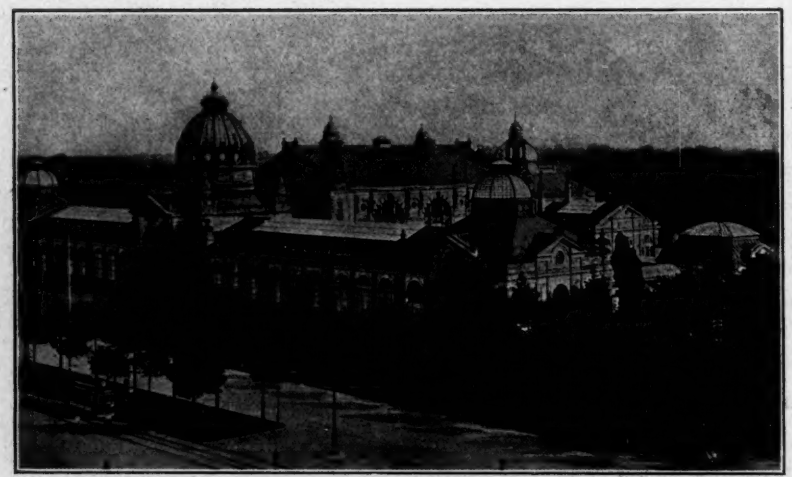


DR. K. A. LENGNER,
President of the Exposition.

Japan, likewise, has contributed a rectangular structure, after a national design, simple but most effective in displaying the exhibits. Switzerland, has put up a building characteristic of the Bervese Netherlands, Spain, Italy, France, Hungary and Amsterdam all have erected pavilions in style of architecture exhibiting the national characteristics in their design. This "rue des nations" shows off well at night when illuminated. Passing out of the "rue des nations" and around the end of the botanical garden, we come in sight of the several large halls, housing life-saving devices, means for the care of the sick and injured, traffic on land and sea, appliances used in the care of prisoners and the insane, army, navy and colonial hygiene. A sylvan restaurant stands at all hours ready to administer to the physical need of the visitor.

A number of smaller buildings, devoted to various purposes, such as the care of the crippled, the housing of the poor, sylvan burial of the dead, the rearing of various species of rabbits for food purposes, a model stable for cows and clean milk production, form the outskirts of this part of the exhibition grounds.

Passing now over the bridge across the Lenné-Strasse which separates the two main divisions of the exhibition grounds, we may either climb the few steps that lead up to the bridge or simply step on the inclined surface of a sidewalk, in constant motion, carrying passengers up at the expense of two and one half cents. The bridge leads the visitor over into the second great division of the grounds. Here we find, on the right, the large hall for occupational hygiene, on the left the power-house; facing the visitor is the gigantic hall marked "Settle-



MAIN BUILDING.

ment and Habitation," one of the richest, so far as contents are concerned, of the whole exhibition. Passing the music stand and turning to the left, we have, on the left, an Abyssinian village; on the right several small and large restaurants and enter a large open space having on one side the large hall devoted to the hygiene of clothing and the general care of the body, on the other the hall exhibiting nutrition, dietetics and food stuffs, while facing us, in the distance, there is the large oval for sports with its stadium, music stand, grandstand, restaurant and sport laboratory, as well as the immense swimming tank called "Undosa." In this swimming tank, artificial waves about three feet high are produced by mechanical means and the bather gets the benefit of an open air bathing resort nearer at home.

The sport laboratory is fitted out with all sorts of scientific instruments and apparatuses to investigate scientifically the effects of physical exercise on the human body, especially on heart and lungs. A gymna-

sium shows the usual development instruments well stocked with material. The great oval is for out-of-door meets and is almost daily in use.

In thus decentralizing the interesting points of the exhibition, the administration was parting company with the principles of housing everything under one roof and thus made a new and very attractive innovation. It avoided overcrowding of the visitors and divided them by a variety of interests located in different halls; it reduced the danger of a large fire, hoping, in case there should be one, to limit it to one or a part of one building by a system of hydrants most generously distributed through the grounds. Through this division of subjects among a large number of buildings it was possible for the visitor to pursue his studies on the subject he was interested in especially, without being disturbed and crowded out by visitors interested in other pursuits.

The Exposition Buildings

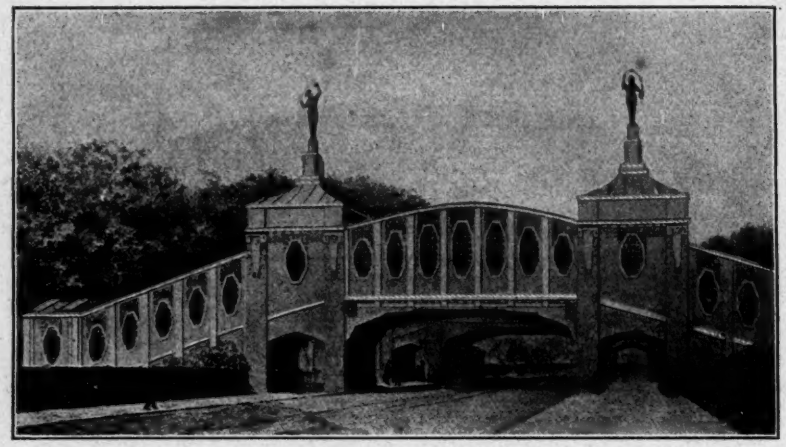
One of the most noteworthy features of the exposition was the architectural beauty of the buildings, including their interior decorations. While the designs of the various buildings differed from each other individually, their structural execution showed that they belonged to the same genus, while all were artistically adapted to the more practical purposes which they were intended to serve. Made principally of wood, all exposed surfaces were provided with a fireproof, coarse-grained covering. Gay, but superfluous, bunting, likely to catch fire and calculated to detract the visitor's eye from the main objects of the exposition, was carefully avoided, while a fine sense of artistic finish, calculated to invite the visitor to concentrate his attentions on the chief objects of the exposition, was everywhere apparent. The quiet, serious character of the buildings, their generous dimensions, large door-ways, wide passage-ways, an abundant provision of light and air, were features without attracting special attention to themselves, that were nevertheless in the most perfect harmony with the serious purposes and the hygienic characters of the exhibition and aided materially in sustaining instead of fatiguing the attention of the visitors.

The Exposition

It could never have been our purpose to attempt giving a full description of this exhibition. Such an undertaking would require a whole corps of editors and end in the publication of a long series of illustrated books. The intention here is to give only a very brief review of a *few* chapters in the greatest living handbook of hygiene ever put together and for which the exposition stood from the beginning and to which high purpose, in reality, it remained true to the end.

Steinpalast

Historical Division.—How deep, wide and far-reaching were the conceptions dominating the minds of those that were called upon to



THE BRIDGE OVER THE STREET.

plan and organize the exposition, was in no department of the exhibition better shown than in the historical division. There was to be no mere comparison between what hygiene is now and that which it represented fifty years ago, but the problem before the organizers was to trace the whole history of hygiene from the remotest beginnings to the present time and to illustrate this gradual evolution by pictures, models and objects, actually dating from those times.

Among the prehistoric Kelto-germanic exhibits could be seen food-stuffs, etc., dating from the stone age. A wall picture from a slightly later period displayed the remarkable fact that the wasp-like waist so much admired on the part of the female sex to-day had been already the ambition of the prehistoric woman. To ward off disease by the wearing of amuletes was already then in vogue.

Prehistoric Babylon shows that, in these remote times, the most detailed precautions were already taken for keeping all sorts of insects off from food articles, especially during the serving of them. The hygienic tendencies of old Babylon are shown in the technique employed in the construction of their wells, canalizations, bathing establishments, latrines and burial systems. The practise of isolating cases of infectious disease, of cleaning food-stuffs before they were eaten and of setting aside a fixed number of days for rest and recreation, was already then commonly observed in Mesopotamia.

The significance of old *Jewish hygiene* is abundantly shown, in the directions on the treatment of articles of food, the regulation for sexual intercourse, the treatment of excrements, burial rites, instituting the regular sabbath which has conquered the world, the priestly inspection of lepers, preserved in old and time-honored rolls of the Tora and further illustrated by sketches, photographs and models.

In prehistoric *Egypt,* the manifest tendency of preserving the human body after death for a future life in an unchanged form is

hygienically considered the most interesting. That the sun-dried soil of Egypt contributed largely to the results obtained is shown when original mummies are compared with the results obtained by artificial drying of animal bodies. To what an alarming extent organized disease-producers had been at work thousands of years ago, on the Nile, is abundantly shown in a large collection of preparations of Egyptian origin in glass bottles.

The statues of the Venus of Praxiteles and of the Doryphoros of Polyklet serve to show how much attention was paid already in those early times by the Greeks to the care and systematic development of the human body from early childhood throughout adult life. That the goddess Hygeia stood in great esteem in ancient Greece is shown in citations from Grecian poets. Models of the recent excavations of the town of Salona in Dalmatia show us a typical Roman provincial town with its splendid streets, water-supply and sewer systems and bathing establishments; a third model, also, shows one of the thermal establishments of Imperial Rome, that of Caracalla. Storerooms for provisions, grain mills and kitchen hearths of Greco-Roman culture are shown in the form of models. Wall pictures complete the illustrations of the dietary customs of ancient Rome and Greece. Numerous models of Etruskan and Sardinian types of houses showing the construction of latrines, the methods of lighting and heating, their bathing establishment, treats exhaustively of the home life of these times.

A special room is devoted to showing how great and thorough were the hygienic precautions promulgated in both Greece and Italy. These

AVENUE OF THE NATIONS.

HALL FOR ARMY, NAVY AND COLONIAL HYGIENE.

ancient framers of the laws already knew the great value to the state of strong and healthy people as shown by the laws they promulgated. Food adulterations also received their due share of attention. But the most significant hygienic characteristic of ancient Rome and Greece centers undoubtedly in the methods of street construction, water supply systems and sewerage systems.

Another special room is devoted to showing the efforts of the physicians of those ancient times as being not alone those of restoring the sick to health, but also those of preventing the well from becoming sick. A plan of the sanatorium in Kos shows its sanitary situation on the south side of a hill covered with trees. Mothers were made to nurse their own children or substitute a wet nurse; the bottle came into consideration only as a feeding instrument of children during the second year of their lives.

The last room of classical antiquity is devoted to burial customs. It is here shown that cremation was not the exclusive method of disposal of the dead in classical antiquity.

We shall have to pass over the different epochs that mark the progress of hygiene during the middle ages, which was shown and interestingly emphasized by a great variety of exhibits, collected from all parts of the world and contributed at great expense, distributed through 22 rooms, both large and small, and in which that gradual but steady progress was shown by graphic, plastic and pictorial exhibits from the time when physicians diagnosed disease by simply looking at the urine-bottle of their patients, up to the period when hygiene began to be taken more seriously and entered into the dignified domain of an experimental science.

We must, likewise, pass over the ethnological portions of the exhibition, although most interesting and highly instructive in showing the customs and habits of the different races peopling our globe and their common desire for a long, happy and healthy life.

In leaving the historical and ethnological groups of the exhibition,

one can scarcely turn aside an ever-increasing impression of the existence of a great variety of distinct and widely differing species of the genus *homo*. Even if a common origin for all should finally be accepted, it will have to be admitted that the genus man has shared in the tendency of all life in general, namely, that of producing varieties, differing almost as widely from each other in their habits and productions as do the various organs in a single individual living animal organism in their functions. The study of the comparative physiology and psychology of races (ethnology), therefore, teaches us that their respective manners, customs and achievements differ in accordance with their hereditary composition and will continue to do so to the end of time.

About 450 individuals and firms had sent contributions to the historical group of the exhibition alone.

The German Workingmen's Insurance

The handsomely bound catalogue by Dr. Klein for the special exhibition, intended to inform the visitor of the work accomplished by the German workingmen's insurance, covering 107 pages, and filled with but the briefest mention of the objects exhibited, will give an idea of the wealth of the material found in Hall 10, presided over by Dr. jur. et med. Kaufmann and Geh. Rat. Weger. The workingmen's insurance, instituted in 1885 by Emperor Wilhelm I., pursues the object of protecting the workingmen against the unavoidable dangers of their calling. Every working man and woman within the boundaries of Imperial Germany is, regardless of nationality, legally insured against disease, accident, invalidity and old age. The sums of money thus contributed to the various workingmen's societies reach the limits of the incompre-

Hall for the Hygiene of Transportation.

CENTRAL ROOM OF THE BUILDING FOR SETTLEMENT AND HABITATION.

hensible. To mention only the sums contributed in this way during the year 1909:

	Marks
Sickness insurance	342,200,000
Accident insurance	162,266,000
Invalidity insurance	189,029,000
Total	693,495,000 or
Daily	1,900,000

The comprehensiveness of the machinery of the workingmen's insurance is beautifully illustrated in the picture of an oak and its effect on the whole body of workingmen is intended to be shown by a figure representing a workingman, designed by Professor Hosaeus, Berlin.

RACE HYGIENE. Director Dr. von Gruber, Munich

Race hygiene has for the first time found a place in hygienic exhibitions. It had for its object the calling of the general attention of the public to the immense importance of heredity upon the prosperity and the degeneracy of the race, upon the inherited constitution which, when strong, bids defiance to unfavorable conditions, when weak, succumbs in spite of the most careful nursing. The public at large must learn to appreciate the necessity for exercising a reasonable amount of care in the selection of a life partner.

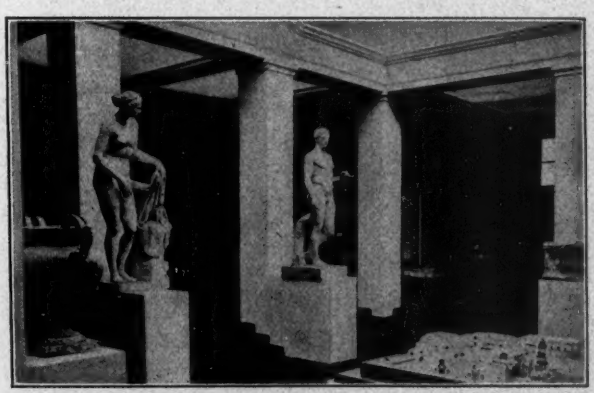
With the aid of 200 tables, charts and colored natural objects, the laws of heredity were demonstrated and it was shown how, through the continuity of germ plasm, in plants and animals, different characteristics are transmitted from one generation to another. The different kinds of variability, as fluctuation and mutation, are made clear. The laws established by Mendel, together with the results of the latest experi-

ments on the transmission through heredity of acquired characters and of diseases, have received due regard.

Attention is also devoted to the question as to whether the nations of the highest culture are increasingly degenerating. The dying out of certain distinguished families and the decrease in number of those fit for military service is taken into account. The special toxic influence of alcohol and syphilis on germ plasm as well as the influence on the race of inbreeding and race-crossing is considered. Finally, the significance of the intentional prevention of conception, or the Neomalthusianismus on the race problem is shown. For further details we must refer to the very comprehensive guide, published by Max v. Gruber and Ernst Rudin, for use in this group of exhibits. This book possesses a value of its own, beyond its mere usefulness as a guide through the momentous group of exhibits.

Sport Division

The organization of the sport division of the International Hygiene Exposition, Dresden, 1911, marks an important epoch in the history of bodily exercises. A rigid classification of sports according to physiological principles has, for the first time, been rigidly carried out. The scientific committee is represented by such men as Professor Zuntz, Berlin, Professor Schmidt, Bonn, E. von Schenckendorff, Görlitz, and many other eminent and learned men. The so-called German Sport Committee stands under the protectorate of the German Committee of Olympic Games: Eæz. von Podbielski, U. von Oertzen and Dr. Martin, presidents, and with the chairmen and secretaries of the large German societies as members. The real working committee is the organization committee under the presidency of Dr. Becker. The special divisions under this organization committee are: academies, fishing, automobile and motor sports, aviation, boxing, ice and snow sports, fencing, women-sports, golf, hockey, chase and shooting, bowling, lawn-tennis, military wheel-field-riding sports, roller skating, rowing, swimming, sailing,



Ideal Figures of Antiquity.

gymnastics and gymnastic games, wandering and mountain climbing. The members of the individual groups were selected from and by the associations distributed over the whole country. From the above an idea may be gained of the comprehensiveness of the organization. The sport exposition was divided into the following subdivisions:

1. Special gymnastic exhibitions by the different unions.
2. Scientific division.
3. Industrial sport division.
4. Sport places and sport plants.
5. Sport laboratory and library.

HALL FOR NUTRITION, DIETETICS AND FOODSTUFFS.

6. Tournaments.

In the sport laboratory were made:

1. Anthropometric and ergographic investigations.
2. Electrocardiographic examinations.
3. Röntgen-ray observations.
4. Examinations on the chemistry and mechanics of respiration.
5. Microscopic and chemico-physiological investigations.

A dark room and a library completed the laboratory. A large number of university men had voluntarily contributed their services to the success of the work. The object of this laboratory was to furnish material for the laying of a foundation for a scientific sport-physiology and sport-hygiene. From results already obtained in this laboratory, some of which I had an opportunity of examining, I am convinced of the fact that a beginning has at last been made for the scientific elaboration of the proper principles upon which alone the different forms of

exercise may be made useful and beneficial, instead of hurtful and dangerous as most of them are now. German sport is intended to remain an amateur sport; it is not to be a wild record breaking mania and struggle for money premiums, to satisfy the overwrought ambitious few; it is not to satisfy the curious wishing to see celebrated champions. The time-honored title of sportsman is to be denied to those who witness a tournament simply because they want to bet on the results. Professionals who are in it for what they can get out of it are not to be called sportsmen; the German sportsman is to remain a gentleman, active without being greedy for gain. The pleasure in tournaments, a national characteristic, is not to be discouraged, but it is not to be regarded as the highest aim of sport. A sentiment for out-of-door sport is to reach the entire nation; it is to bring the individual citizen from his office and workshop out under the influence of God's sunlit nature, to enable him to stretch his limbs and to fill his lungs with oxygen and his mind with the beauties of nature.

Manly virtue, endurance and resistance are to be placed above calcified arteries, enlargements of hearts and collapse. To this program the sport division of the exposition has remained true throughout.

The Significance of the Hall, Marked in Large Golden Letters, "DER MENSCH" at the Internationale Hygiene-Ausstellung

The conventional attitude in fashionable society of displaying an unconscious ignorance with reference to everything concerning the structure and functions of the different organs of the human body is gradually losing the character of its traditional respectability. The forces at present operative in shaping the destinies of human races have rendered such a display of lack of knowledge culpable to a degree and its further cultivation a crime. The most formidable governing power in any free and enlightened country being admittedly based upon a sound public opinion, itself a function of the degree of the general health of its citizens, it clearly becomes the duty of every individual to contribute to this constitutional asset of his commonwealth, in proportion to his personal intelligence and educational standing, as the most valued tax that can be levied on his citizenship, for it seems pretty well acknowledged that the future will belong to the nation possessing the greatest number of strong, healthy and physically as well as mentally resistant individuals.

As a contribution to the methodology of disseminating such knowledge among the people in the most effectual manner, the hall of popular hygiene at Dresden stands preeminent in recent times. Structure and functions of the human body were never before presented in a more easily assimilable form. The conditions necessary for the preservation of health and for the prevention of disease were never before set forth in so easily intelligible a manner. Neither expense nor pains had been

FIELD HOSPITAL.

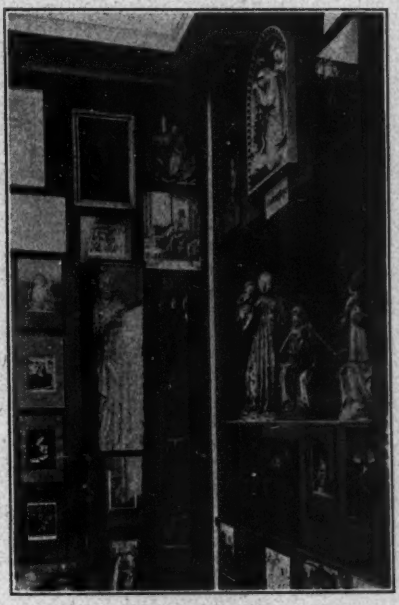
spared to render clear to the understanding the mysteries of health and disease. All the available arts and sciences had been pressed into service of this great object. The systematic representation of the subject was pursued with great consequence. An introductory lecture was given in the great hall every morning. A culture of living protozoa was projected on the screen in an adjoining dark room, their life histories explained. In another dark room, the production of antibodies in the blood, excited by the action of bacteria, was shown on the screen. Then, the life cycle of the silk worm and the preparation of silk was similarly shown on the screen. Over one hundred microscopes, all in the most perfect working order, and under a splendid system of illumination, served to demonstrate monocellular organisms, mitotic cell-division, fertilization and embryonic development as well as the adult cellular structure of every organ in the human body.

The gradual development from a single cell of some of the lower animals as well as intra-uterine development of the human embryo was beautifully shown by a series of embryos rendered transparent by the method of Spalteholz. A splendid series of wax and plaster models in

FIELD KITCHEN.

glass cases, greatly assisted by attached mechanical devices, helped the understanding of their structure and function.

The adult human body was, in its entirety and in parts, shown in the natural state, in the form of models, paintings, lumières and drawings, all displayed in the most artistic form and executed by artists of the first order, the high walls and high windows admitting a flood of light and rendering inspection thorough and easy. Mechanical devices were in operation for showing contraction of muscles; for explaining the action of the nervous system and the differences between mere reflex action and an action involving the cooperation of the higher nerve centers; for showing the circulation of the blood by a system of capillary glass tubes and the amount of work done by the heart; for demonstrating the function of the special senses and the mechanism of respiration and of voice and sound production. The subject of nutrition was given a prominent place. The more elementary chemical substances constituting the principal natural food products were shown in glass bottles and, further, shown by charts to which the percentage number of each elementary substance was attached, with the daily amounts of each required by man. Against a wall, there were arranged the quantities of water, salts, proteids, fats and carbo-hydrates which man consumed in a year and in the form of natural foodstuffs. At another table we were introduced into the mysteries of food adulteration and shown how cinnamon was made out of brick dust, pepper out powdered linseed oil-cake and strawberry syrup without strawberries.



CARE OF CHILDREN IN THE MIDDLE AGES.

COSTUMES OF MODERN TIMES.

THE IDEAL WORKMAN. By Professor Hosaelus, Berlin.

The toxic substances contained in alcohol, tea, coffee and tobacco and their influences on longevity and human happiness were all exhibited in a most tangible form. Table and kitchen utensils of the most varied composition and form were shown in separate cases.

A special group was devoted to housing, showing the best methods of heating, ventilating, illuminating and cleaning our dwellings.

In the group of occupational hygiene the visitor was shown the dangerous influences to which workmen are exposed in the different factories and the beneficial appliances recently devised and put into operation to prevent them.

The visitor was thus prepared to pass into the section in which the common infectious diseases of man were shown, how they originate and how they are best prevented, at the same time exhibiting busts of the

most noted men of science who have contributed most to our knowledge in this department of sanitation.

A most noteworthy feature also was the development, care and best mode of nutrition for nurslings; it was here shown that the care for the child must begin before birth and must extend to the mother. Of great interest were the demonstrations given on the subject of nutrition of the nurslings; their weight and size, the treatment of the diseases of children, the care of the skin, the duration of sleep, etc.

A most telling story is also told on the subject of dental hygiene.

The department of the general care of the body to be observed during childhood, adult manhood and old age is most impressive and so plainly told and shown as never to be forgotten.

When we add to all this that daily demonstrations in every one of these groups were given by the most eminent men of science, engaged for the whole time of the exposition, it is easy to explain the ever-increasing number of visitors to this hall and the fact that, towards the last part of the exposition, the hall had to be opened at night on special admission tickets, sold, to satisfy this ever-increasing thirst for knowledge. It simply had become thoroughly recognized that it was within the capacity of every man and woman to accumulate, in this hall, sufficient knowledge of the laws of health to provide for oneself that modicum of health which forms the most solid foundations of all human happiness. It had become realized as never before that health means bodily, mental and moral perfection, its cultivation resulting in strength, beauty and happiness.

Foreign Pavilions

Amsterdam.—The city of Amsterdam had contributed valuable exhibits. The most interesting from the hygienic viewpoint were undoubtedly those of the city health office, consisting in tables, curves and microphotographs, the results of the chemical and bacteriological examination of food-articles and condiments; the control of infectious diseases and the ways and means employed in fighting their spread. Most interesting also were the exhibits demonstrating the difficulties experienced in Amsterdam with regard to its water-supply and the ingenious methods employed by its people to overcome them.

Brazil.—Those unacquainted with the amount and high character of work done, in recent years, in Brazil, by the public health authorities there, were surprised to see the wonderful exhibits in the Brazilian pavilion and to witness the daily kinematographic demonstrations of the actual field work done in that country, to fight yellow fever and other infectious diseases. The sanitary service of Brazil seems to be well organized and the work is done by the most improved methods and with the use of modern instruments. Completely equipped laboratories of bacteriology, chemistry and pathology are at the command of the sanitarian. Thus, under the sanitary supervision of Dr. Oswaldo

Cruz, now continued by that of Dr. Figueiredo de Vasconcellos, the pioneer leaders in this work, Rio de Janeiro is now free from yellow fever and one of the healthiest cities on the Atlantic coast of South America.

China.—The government of China, through the erection of its beautiful pavilion, filled with exhibits covering all the present departments of hygiene in the Chinese Empire, has succeeded in demonstrating its interest in and desire for the introduction of hygienic methods into the country. The members of the Chinese commission

HALL FOR WORKINGMEN'S INSURANCE. IN THE REAR THE HALL FOR CHEMISTRY AND SCIENTIFIC INSTRUMENTS.

have been instructed by their government to study hygiene and sanitation in all the European states, with the view of applying these methods to the needs of the people inhabiting the Chinese Empire. The opportunities for the beginning of such a study could never have been more advantageous than they were at the exposition of Dresden.

England.—Under the high protectorate of H. R. H. Princess Christian of Schleswig-Holstein and the presidency of the Right Hon. The Lord Mayor of London, a British National Committee, numbering about 250 members, was formed at the eleventh hour, for the purpose of giving the British people an opportunity of giving expression of their sympathy with the exhibition and its high aims, by contributing their exhibits and thus largely adding to the completeness of the results of the undertaking. Being an almost daily visitor at the British pavilion for several weeks, and, attending the daily demonstrations by Dr. Armit, I can not but express my great admiration at the completeness

of the exhibit got up in so short a time and covering almost every department in hygiene. A pavilion several times its size could scarcely have held any more than did this small pavilion of Great Britain. Much of this success, of which the British people may feel proud indeed, is no doubt due to the personal efforts of Sir Thomas Barlow, The Right Honorable Lord Ilkeston, Professor G. Sims Woodhead, the executive committee, and to the untiring energy of its skilful and learned executive secretary and demonstrator, H. W. Armit.

France.—The pavilion erected by the government of the Republic of France, was one, characteristic of the eighteenth century French architecture, designed by M. Tronchet, the architect-in-chief of the French government. Beautiful in construction and appearance, it was further favored by location.

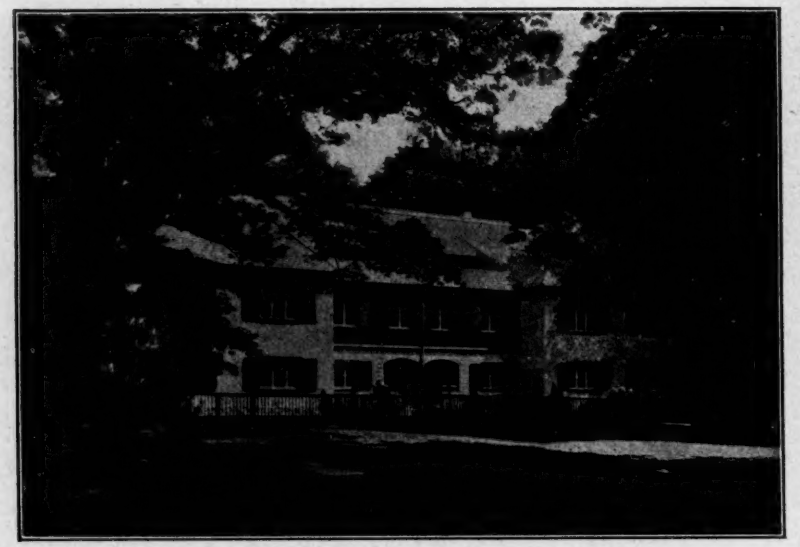
The French executive committee, of which Professor Fuster was chairman and Drs. Calmette and Landouzy members, had been obliged to adhere to a program of exhibiting none but objects of an administrative and philanthropic character. If industrial exhibits were nevertheless accorded a place they only served the purposes of demonstrating the progress made in technique employed in vaccination, disinfection, canalization, sterilization and the methods of water-supply.

The bulk of the exhibits consisted in collections of drawings, paintings, photos, models, relief maps, charts, showing the achievement of French scientists along hygienic and philanthropic lines. A most creditable as well as a most beautifully arranged exhibit.

Japan.—The pavilion of Japan, planned by Dr. ing. C. Ito of Tokio and executed by Alfred Pusch, Dresden, was characteristic of the country, simple, impressive, artistic, economical as well as adapted to its purposes. The commission sent by Japan consisted of eight representatives of the government, famous for the work they had done in their respective lines and one of the best known among which was Professor Dr. Miyajima, of the Imperial Institute for Infectious Diseases of Tokio.

The exhibits covered almost every department of hygiene, making this exhibition one of the completest in this respect among foreign pavilions. A fine model of Fujiama greeted the visitor on entering. The beauties of the country, its climate, were abundantly shown by models, drawings, pastels, photos, etc. The hygiene of nutrition, of clothing, the methods of housing and living, education of children in schools and homes, the care of the sick, safety devices, the prevention of epidemics, the history of development of medical sciences in the country all have received careful attention. But most impressive, if not positively inspiring, were the exhibits and background paintings showing the work of the sanitary corps while an action was in progress as well as that of the army field kitchen.

A special pavilion, " Formosa," under the special care of Dr. Takaki,



SIX-FAMILY TENEMENT.

served to show the great sanitary improvements made by the government of Japan since it had taken possession of that island.

Italy.—In spite of the fact that Italy, during 1911, had to supply three different expositions of its own, namely: Rome, Turin and Florence, it found means of erecting and supplying a pavilion of its own in Dresden. The six groups into which the exhibits were divided were arranged in very good taste, giving and making a rather artistic impression. The exhibits were for the most part statistical and graphic.

Austria.—Austria's pavilion was one of the largest and perhaps the richest of all the foreign pavilions erected at the exposition. It represented a *multum in parvo* of the whole subject of hygiene and no simple description could do it justice; we must refer to the special catalogue and guide, published by the administration, for a detailed list of the exhibits and of the distinguished names of their contributors, as well as the corps of managers who had charge of this pavilion.

Russia.—Russia had been one of the first foreign countries declaring its readiness to erect a special pavilion at Dresden. The pavilion is a two-story structure designed by Professor Pokrowsky, St. Petersburg, and forms perhaps the largest foreign pavilion. As regards the contents, we can only repeat what was said of the Austrian pavilion, namely, that they covered the whole subject of hygiene.

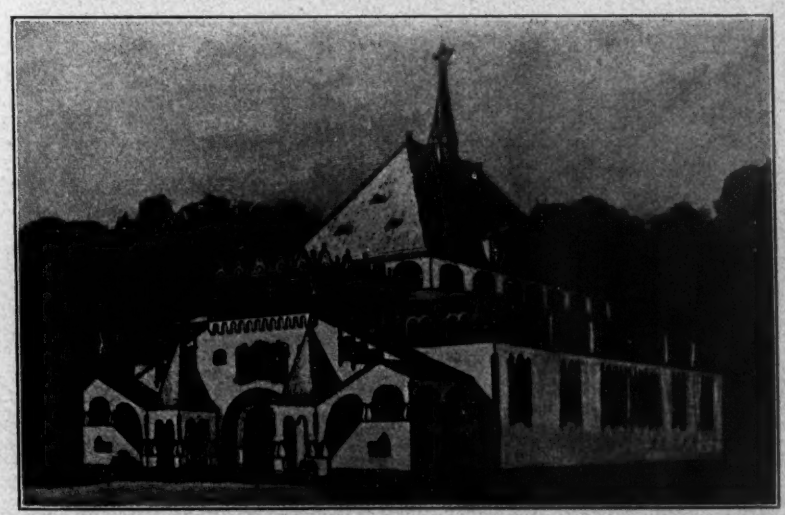
Switzerland.—The exhibitions in the Swiss pavilion were divided into ten chief and three special groups, extending over the entire field of hygiene. These exhibits served to place the small republic in the front rank of hygienic countries and reflect the greatest credit on its national committee of 100 and its executive committee, of which Drs.

H. Carrière, W. Kolle, Ost and Schaffer were members. Of quite special interest to military men was a new and quite well-adapted wheeled army field-litter.

Spain.—Spain had erected a neat-looking pavilion, the exhibits consisting for the most part of graphic and pictorial wall charts, statistical tables, etc., very artistically arranged. Drs. Pulido and Chicote, the Spanish representatives, received their commissions too late to enable them to collect a more representative exhibit. The exhibits nevertheless showed that Spain is awake to the progress in all departments of hygiene, plainly demonstrating its keen interest by its participation in the exposition in Dresden.

Hungary.—The visitor to the exposition would hardly have looked for a special pavilion representing Hungary after having seen the one erected by Austria. But so great was the interest of the Hungarian government in the exposition and its high aims at Dresden, so much had been done there in recent years to improve the hygienic conditions of its people and its institutions and so different from those of other countries were the hygienic requirements of Hungary, that the Hungarian exhibits, many of which were quite original, aroused and sustained the interest which they so well deserved. The special catalogue and guide, by Professor Emil von Grosz, covering 48 pages, must be allowed to speak for the rich collection seen in this pavilion. Special sympathy was aroused with the visitor on the subject of those institutions which were devoted to the governmental care of abandoned children. The Hungarian people believe that every abandoned child has a right to be cared for by the community.

United States.—If absence, ever before, was conspicuous anywhere, it was the absence of a United States pavilion at the exposition at



THE RUSSIAN PAVILION.

Dresden, 1911. The "humiliating blush of shame" anticipated in my letter to the American Public Health Association (*Am. Jour. of Public Hygiene,* Nov., 1910, p. 858) could be seen on the face of every American at the exposition and realizing the gravity of the situation. While the flags of every civilized nation could be seen floating merrily to the breezes, the stars and stripes were missing. The humanitarian eye among its stars played no part in, had no sympathy with, no contribution to offer for, this most Christian endeavor to raise the hygienic standard among the nations of the world, so fundamental to international happiness and international peace which we so loudly acclaim.

While the real cause of this may never become known, the stain, created by this demonstration of indifference, will remain a lasting reproach to the American people, especially to its public health officers.

THE VALUE OF NON-INSTRUMENTAL WEATHER OBSERVATIONS

By Professor ROBERT DeC. WARD
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MUCH emphasis has been laid—and rightly—upon the necessity, in climatological studies, of systematic observations, carefully checked, punctually recorded and extending throughout many years, of properly exposed standard meteorological instruments. Upon such observations the scientific study of the world's climatology must be based. Without them everything remains vague; no real comparison of climates is possible; no detailed investigations of climate in relation to health, to crops, to industry, can be undertaken. Our conviction has become fixed that unless we can keep such a series of standard records, with a considerable and expensive instrumental equipment, it is not worth while to attempt any meteorological observations whatever. This is far from being the case. There is a very considerable series of observations—non-instrumental, unsystematic, irregular, "haphazard" if you will—which any one with ordinary intelligence and with a real interest in weather conditions may undertake. Such a diversion will add greatly to the interest of our humdrum every-day life, and will develop from day to day, in a surprising way, powers of observation which we were unconscious of possessing. Obviously, when such non-instrumental observations can be made at regular hours, at one place, they lead to a more compact and complete result than when they are made at odd times, in different places, as during a journey.

During the past summer, while recovering from a recent illness and therefore not wishing to burden myself with routine instrumental observations, I have found great satisfaction among the New Hampshire hills in working out day after day the local meteorological conditions. I have tried to banish from my mind altogether my previous knowledge of the climate of the region as a whole, and of the meteorological phenomena of mountain districts in particular. Thus, open-minded and unprejudiced, as far as possible, I have gradually worked out the essential elements of a local, non-instrumental climatology—an undertaking which has given me great interest, and I frankly confess has added not a little to my general store of climatological knowledge.

During the excessive heat of the first part of July (1911) it was comforting to note[1] that the maximum temperatures up in the New

[1] A sling thermometer was used in this case.

Hampshire hills averaged 3°–5° lower than at the Weather Bureau station in Boston, and that the nocturnal minima in the clearer air and at the higher altitude of my hillside were also several degrees lower than the disagreeably high minima of the city. The very regular occurrence of marked up-slope and down-slope ("mountain and valley") winds on all fine days; the increasing wind velocity towards noon and in the early afternoon, with calm mornings and evenings ("diurnal variation in wind velocity"), on these same days; the wonderful growth of cumulus clouds on the surrounding mountains and in relation to them; the development of cloud banners, cloud caps and cloud cascades; the effect of the general topography upon the local wind direction; the development of low-lying valley fogs at night, their gradual rise as fracto-stratus clouds and their dissipation under the morning sun; the marked difference, in relation to exposure to the cool nocturnal downhill breeze and to valley fogs, which neighboring house-sites exemplified; the apparent development of small local thunderstorms over the near-by mountains, while the larger thunderstorms came across these same mountains unaffected by the topography—these were a few of the many things which my very casual observations emphasized. Apart from these special subjects the general sequence of the larger weather changes resulting from cyclonic and anticyclonic controls was, of course, noted. So distinctly worth while has this simple and far from burdensome undertaking proved that I heartily recommend others to try it, but let it be repeated that real interest will come only if all previous meteorological knowledge of the region is, so far as possible, banished from the mind. And let me warn every one that he must beware lest his meteorological explanations run counter to the general traditions of the community. The location of most of the abandoned farmhouses in the region where I spent the summer, on the hillsides or even hill-tops, seemed to me to be most naturally explained on the theory that they were placed there in order that they might be above the cold and frost and fogs of the valley bottoms. One of my neighbors, who firmly believed that these houses were placed on the hill-slopes so that their original owners might have early warning of the approach of Indians, has upbraided me with shattering all the old and romantic traditions of the place. Let me suggest, further, that a very simple study of the value, as prognostics, of many weather proverbs will prove an interesting occupation. Weather proverbs are good, and bad, and indifferent. Most of them are bad, that is, do not work at all. A large number are indifferent, that is, work both ways. Comparatively few are really good. It is well worth while to select a few of the best known proverbs and keep careful written record of the times that each one "hits," *and also of the times that each one "misses."*

Most people count the "hits" and disregard the "misses." If such a record be kept, the wheat will be separated from the chaff, but a week or a month of record, while long enough to bring out much of interest, is far too short a time for purposes of scientific comparison of relative values.

Travelers, even when passing rapidly through a country on the railroad, and, still better, when moving more slowly on horseback or on foot, usually have opportunities for making simple non-instrumental observations which will add greatly to the interest of their journey, and which, if the region is comparatively little known, may really be of considerable importance. I have long felt that what I have termed "car-window climatology" deserves far more attention than it has received. In my own experience when traveling in South America under conditions which usually made it impossible to carry any instrument except a sling psychrometer, it was found feasible, when journeying on horse or mule back, on the Brazilian "trolley," or in the train, to collect facts which added greatly to my understanding of the climatology of the regions passed through; made the trips alive and interesting, and helped to hasten the passage of many weary hours. Some of these observations, indeed, it has seemed worth while to publish. There are many observations which an intelligent traveler can make, even from a car-window, although a slower method of progression is, of course, to be preferred in such a study. Wind velocity may be reasonably accurately estimated, after a little practise, by noting the effect of the wind in blowing trees, or in producing waves of different sizes in lakes or on rivers. The prevailing wind direction can often be very accurately determined by observing the slant of wind-blown trees, or again, by taking note of the effects of wave action on the leeward side of a lake or pond. Vegetation always furnishes a *general* criterion in regard to temperature and rainfall. When trees shed their leaves we infer a season of cold or it may be of drought. The occurrence of frost may be detected both by seeing it, and by noting its effects. The altitude reached by frost may likewise be observed. The direction of rainy or snowy winds may be discovered by observing on which side trees are wet. Whether or not hail, or snow, or sleet, or frozen rain, or gales, or heavy rains, or fog, occur in a region is observable, so far as the period of his visit is concerned, by any traveler. Forest and prairie fires indicate droughts, or dry seasons. Tornadoes and high gales, may be detected many years after their occurrence by the damage they did to trees. Whether or not a river is subject to floods may usually be determined by such hurried observations as can be made from a car-window, by noting the mud deposited by former floods on the trunks of trees, or by seeing the banks and neighboring fields actually overflowed.

The condition of the roads, whether dusty or muddy, indicates in a general way the occurrence or lack of recent rainfalls. And thus, through a long list, we might go on. Non-instrumental, even irregular and scattering observations of meteorological conditions, and of their effects, are well worth while, if intelligently made. Such observations should be more generally undertaken.

During the short semi-vacation of the past summer I have found much interest in reading the "Journals" of the Lewis and Clark Expedition "to the sources of the Missouri, across the Rocky Mountains, down the Columbia River to the Pacific in 1804–06" What struck me particularly was the remarkably clear picture which I gained of the climatic conditions of the then unknown country through which, amid great hardships and many dangers, this famous expedition passed. The leader of the expedition was charged by the President with reporting upon very many matters besides meteorology.[2] Yet, in spite of the many difficulties of the journey, and with only one instrument—a thermometer—which was unfortunately broken before the end of the trip, the observing eye of Captain Lewis was able to note a variety of meteorological and climatic facts which give a vivid picture and emphasize, in a striking manner, the kind and the value of simple weather observations which any intelligent traveler can take.[3] In view of the many hardships of the journey, it is surprising to see how few gaps there are in the record,-which covers the period January 1, 1804–September 30, 1805. Between May 14 and September 18, 1804, there comes the only considerable gap, with the significant comment: "The party were then just beginning the ascent of the Missouri, and it is probable that amongst the many other important things which engrossed their attention this was omitted." The tables give date, and thermometer, weather and wind direction at sunrise and 4 P.M.; also the rise and fall of rivers, in inches and feet.

The thermometer readings have, perhaps, less value than might be expected, partly because they could not be continued throughout the ex-

[2] President Jefferson instructed Captain Lewis to report upon climate as follows: "Climate, as characterized by the thermometer, by the proportion of rainy, cloudy and clear days; by lightning, hail, snow, ice; by the access and recess of frost, by the winds prevailing at different seasons; the dates at which particular plants put forth, or lose their flower or leaf; times of appearance of particular birds, reptiles or insects."

[3] Captain Lewis's scheme of notation of weather was as follows:

f, fair weather.
r, rain.
h, hail.
l, lightning.
c a s, cloudy after snow intervening.
c a r s, cloudy after rain and snow.
c, cloudy.
s, snow.
t, thunder.
a, after, as *f a r* means fair after rain which has intervened since the last observation.

pedition, partly because they were made but twice a day, and partly because it is unlikely that the instrument was always well exposed.[4] The highest temperature noted was 92° (July 31 and August 4, 4 P.M., 1805), and the lowest was — 45° (sunrise December 17, 1804). Clearly the expedition passed through a country of large annual and diurnal ranges of temperature (east of the Rocky Mountains). The summer afternoon temperature rose to 70°–80°, and even 90°, while in winter the sunrise readings were as low as — 20°, — 30° and even — 40°. The diurnal ranges are noted as having been extremely large among the mountains, and on one day a difference of 59° was noted between sunrise and 4 P.M. The prevailing summer type of weather was fine, warm or even hot days, with cooler evenings and nights; not infrequent thunder-storms, moderate to high winds, especially in the afternoons. The southerly winds are so often referred to that we have little hesitation in concluding that this is the prevailing direction in summer on the Great Plains, and we see at once, in our mind's eye, that great sweep of southerly and southeasterly winds, across the region west of the Mississippi River—the continental inflow of summer, in response to the pressure-gradient between the Gulf of Mexico and the interior of the continent. These winds are frequently described as of high velocity during the daytime, blowing the sand from sand-bars and river-banks. Within the past quarter-century these same winds have been harnessed for the service of man, and they are to-day driving hundreds of windmills on the Great Plains for pumping water for stock and for irrigation, for sawing wood and for grinding corn and wheat. Captain Lewis observed that "the winds blow with astonishing violence in this open country." We have learned since that their velocities are not only high, comparable with those along the seaboard, but that they are also very uniformly distributed through the year, and are "usable" for windmill purposes to a remarkable degree. But no more striking illustration of the wind velocities on the plains has ever been given than Captain Lewis's description of the occasion when one of his boats, which was being transported on wheels, was blown along by the wind, the boat's sails being set! Surely this account emphasizes the analogy between the winds of the ocean and the winds of the Plains. Both sweep over a surface of little friction. Both attain high velocities in consequence.

The frequent occurrence of rain in May and June emphasizes the season of maximum precipitation (the "Missouri Type" of Gen. A. W. Greely) which has since proved of such immense economic benefit

[4] It should be noted, however, that at the beginning of the table of observations, where the first data are given, for "Duboes," January 1, 1804, it is stated: "Thermometer on the north side of a tree in the woods." This surely indicates careful attention to exposure, when possible.

over this great region, for on the whole the most rain falls when it is most needed for agriculture. A different seasonal distribution of precipitation would banish agriculture from thousands of acres of land which are to-day giving our farmers good crop returns. The fact did not escape the watchful eye of Captain Lewis that the rainfall of the warmer months over the region which he crossed is essentially spasmodic and "patchy" in character, *i. e.*, is of the shower or thunderstorm type, as contrasted with the more general and widespread rains and clouds of the large storms which characterize the winter months over the country as a whole. It is this very peculiarity of "patchiness" of the warm-season rains which renders them disappointing to the farmers whose crops are suffering from drought. A half-hour shower, covering perhaps a very small portion of a state, is a terribly exasperating occurrence to those whose lands are "screaming for water," but are outside of the limited area covered by the rain. Further, the fact that there is "very little rain or snow either winter or summer," is a sufficient emphasis on the general decrease in the rainfall to the west of the Mississippi River, which is so marked a feature on our mean annual rainfall maps. Captain Lewis paid particular attention to thunderstorms, in which, probably because of their violence, he seems to have been much interested. On April 1, 1805, he wrote, "I have observed that all thunder clouds in the western part of the continent proceed from the westerly quarter, as they do in the Atlantic states." This is perhaps the first specific mention of this important meteorological fact. On May 18, 1805, the record states: "We have had scarcely any thunder and lightning; the clouds are generally white, and accompanied with wind only." This we may take to indicate that the season of maximum thunderstorm activity had not begun, the clouds were doubtless our typical summer cumulus clouds, which, being best developed when the wind is strongest, *i. e.*, in the warmer hours, are often called "wind clouds." A thunderstorm which occurred on June 27, 1805, receives special mention. This storm lasted two hours and a half, and was accompanied by hail about the size of pigeons' eggs, which covered the ground to the depth of 1½ inches. Some of the hail-stones rebounded from the ground to a height of 10 or 12 feet. Several of the men were knocked down and bruised; some got under the canoe for protection, and others covered their heads. One hail-stone weighed 3 ounces and measured 7 inches in circumference. The stones were generally round, and perfectly solid. Captain Lewis adds: "I am convinced that if one of these had struck a man on his naked head it would certainly have fractured his skull." On July 6, 1805, another thunderstorm brought hail which covered the ground and was near the size of musket balls. One blackbird was seen to be killed by the hail,

and Captain Lewis was "astonished that more have not suffered in a similar manner."

Our general understanding of the essential climatic characteristics of the country through which the expedition passed, already reasonably accurate although only in outline, becomes clearer as we pick out other details which are noted in the journals. "The air is remarkably dry and pure in this open country. . . . The atmosphere is more transparent than I ever observed it in any country through which I have passed," Captain Lewis says, thereby bringing out very clearly one of the great climatic advantages of the region. The rapid evaporation, which has its disadvantages as well as merits, was frequently observed. Thus (September 23, 1804) on one occasion "in 36 hours 2 spoonfuls of water evaporated in a saucer," and elsewhere in the "Journals" we note that the rapidity with which Captain Lewis's ink dried up was recorded as furnishing a striking illustration of the dryness of the air. Surely that gives us a hint as to what can be done by a traveler who is alive to what is going on around him. The difficulty of making any accurate estimate of distances in the air of the mountain country, so much drier and purer than that to which he had been accustomed, struck Captain Lewis forcibly. Similar difficulty has been experienced by many persons whose eyes have become trained to estimate distances in turbid air near sea-level, and find, on mountain tops, that their whole scale of distances must be revised in order to allow for the greater clearness of the mountain air. Although the winter was spent on the Pacific coast, there was no lack of opportunity to observe frost and cold on the Plains and northern plateaus. Frost we find recorded as "white," "hard," "very hard." The thickness of ice frozen in a day is often recorded. On October 18, 1804, we note that water in vessels exposed to the air was frozen, as was "the clay near the water edge." And on another occasion (April 15, 1805) "the earth at the depth of about 3 feet is not yet thawed, which we discover by the banks falling in and disclosing a strata of frozen earth." It was recorded that snow fell on the mountains while rain fell at lower levels—a common phenomenon resulting from the lower temperatures aloft. The occurrence of nocturnal radiation fogs; the prevalence of cold northwesterly winds in the colder months (as contrasted with the warm southerly and southeasterly winds of summer); the depth of snowfall; the appearance of auroras, and of haloes and other optical phenomena; the migrations of birds; the coming of rains with northwesterly winds (this being a combination which is not very common in the eastern United States, but occurs more frequently in the west)—these are a few of the many instructive observations which have been picked out in a rather haphazard way from the very rich harvest in the "Journals." The occur-

rence of a heavy dew near the Falls of the Missouri is attributed to the greater dampness of the air in that place resulting from the spray produced by the falls. This reminds one of the reported appearance of dews in the vicinity of desert oases, and of the tradition that travelers across deserts have often been assured of their approach to an oasis when they have observed that dew forms at night. The frequent firing of the grass on the Great Plains by the Indians is often referred to, but there is no reference to the possible effects of this custom upon the treelessness of the region.

The winter time which was spent by the Lewis and Clark Expedition on the Pacific coast, at the mouth of the Columbia River, gave Captain Lewis abundant opportunity to observe the meteorological and climatic peculiarities of that region, and to contrast them with those with which he had become familiar in the east. "The loss of my thermometer I most sincerely regret," he wrote on January 3, 1806. "I am confident that the climate here is much warmer than in the same parallel of latitude on the Atlantic Ocean, though how many degrees it is now out of my power to determine." A few days later we read, "Weather perfectly temperate. I never experienced a winter so warm as the present has been," and note is made of the fact that the Coast Indians wore, and needed, less clothing than those east of the mountains. Clouds, and heavy rains and gales—much changeable stormy weather and very little sunshine—made such an impression that Captain Lewis wrote, "The vicissitudes of the weather happen two, three or more times in half a day." The early part of the winter was so mild that, as already noted, it could not fail to attract attention for that reason. There being no ice, meat was smoked in order to save it, and even that method was by no means uniformly successful. Later on, however, we find frequent mention of greater cold, of snow and of "hail" (frozen rain?). On January 28, 1806, a vessel of water was exposed in order that the thickness of ice might be measured. Unfortunately, the water was only two inches deep, and it froze to the bottom. "How much more it might have frozen had the vessel been deeper is therefore out of my power to decide," was Captain Lewis's interesting and critical comment. It is clearly stated that the winds from the land were cold and clear, while those obliquely along the coast or off the ocean brought warm, damp, cloudy and rainy weather. Thus a significant climatic control received early and explicit recognition. Later in the winter (March 6) this earlier statement was qualified as follows: "Easterly winds which have heretofore given us the only fair weather we have enjoyed seem now to have lost their influence in this respect." The strongest winds came from the southwest. There is further an interesting statement to the effect that a certain harbor was not protected

against southerly and southeasterly winds, but as these seemed to be winter winds the harbor would doubtless be safe in summer. The explanation, which could not be given in Captain Lewis's time, is to-day found in the frequency of strong southerly winds during the cyclonic storm season (winter) of the Pacific coast. If any one can read Captain Lewis's weather record for the northern Pacific coast without gaining from it a vivid idea of the cloudiness, the heavy rainfall, the high winds, the small amount of sunshine and withal the mildness of the winter of the particular district which the expedition encamped, he must be a hopelessly unappreciative and unintelligent person.

In looking over what I have written on the weather records of the Lewis and Clark Expedition, I realize that I have failed to bring out, with any of the clearness which it was my hope to secure, the climatic picture which Captain Lewis makes so distinct and so interesting. In spite of the deficiencies in my presentation, I hope, nevertheless, that I have to some extent succeeded in emphasizing the value of non-instrumental meteorological observations.

NARROW JAWS AND SMALL FEET

By RICHARD COLE NEWTON, M.D.

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A FEW simple precautions in rearing our children would redound to the development of the race in quite unexpected ways. The writings of Bogue and others have proved that the small jaws and irregular teeth of Americans are due to the simple fact that the teeth and jaw bones have never been developed by chewing hard foods as nature intended us to do. As one consequence of this non-development, the teeth are poor in their chemical constituents, which, added to their irregularity and consequent non-occlusion, renders them so prone to decay that a middle-aged man or woman with a complete denture (*i. e.*, 32 teeth) is so great a rarity that dentists are wont to rejoice when they discover such an one, even as the angels are said to do over one sinner that repenteth. In like manner the chiropodist might be supposed to rejoice, if one in his humble calling has the springs of joy within him, over the equally great rarity, a perfect adult human foot. For there is only one other thing so generally distorted and defective as the average human jaw, and that is the average human foot. We bring our children up to despise the Chinese who deliberately distort and malform the feet of their female children. Our virtuous conversation incites in our children's minds a horror of the foot-binding process by which the Mongolian parents prevent the natural growth of their daughters' feet and thus improve (sic) upon nature, and yet we allow our daughters to wear so-called Cuban heels and French heels and pointed-toed shoes, sometimes called one-toed shoes, until their feet are as truly malformed as the Chinese woman's, albeit in a less degree.

There seems to be more logic in the Chinaman's distortion of the foot than in that of the occidental races. We are assured that no Chinese woman of rank can expect to marry well if she has natural feet, like a working woman, any more than our girls expect to marry well if they have a natural waist. A Chinese lady of high degree abroad upon the highways must be attended by two or three maids or helpers supporting her, to show to the admiring multitude that she can not walk without help. This is what her feet have been compressed for. This proves that she is a lady and fully fitted to marry a gentleman of rank and attainments. The gentleman, on his part, has also taken pains to show that he is incapacitated for manual labor. His finger nails have been allowed to grow to an incredible length and for fear that they may

be broken and look stubby, like a laboring man's he has small cases made, I believe, of ivory or some fancy wood, to draw on over those prolonged nails and preserve them intact.

Americans do not seem to be quite so anxious to prove to the outside world that they are incapable of walking, or of manual labor, as the Chinese, but they are extremely desirous of looking chic, smart and up-to-date, and we have seemingly as great a horror of feet which have grown to their natural size, as the celestials. We uniformly buy our shoes from a size to a size and a half too small for us. We do not realize that our feet should spread, not the toes alone, but the whole foot, like an animal's paw, with every step we take. Why we have the insane delusion that our feet should be small, out of all proportion to our bodies, no one so far as I know can explain. Orators have praised small feet, and poets have sung to them. Fashion plates have depicted them and lovers have sighed for them, and really from want of proper use, from compression and from the consequent arrested development because of their being encased in unyielding leather boxes from early childhood, our feet are much smaller in proportion to our size and weight than they should be. But this is not all. By reason of the absurd pointed-toe shoes, which men and women both wear, man is becoming practically a unidactylous animal. That means that we cultivate our great toes and let all the others atrophy for want of use, when they are not doubled up or twisted over each other so that standing on the feet for any length of time, not to mention walking, is exceedingly painful and sometimes impossible. In these cases the pointed shoes have been adopted after the smaller toes have grown somewhat, and like those of the unfortunate Chinese girls, they must be crowded out of the way, for no genteel person in either China or America can afford to have the toes spread out as nature intended them to be. Often, however, the pointed shoes have been worn in early childhood and the poor little toes, in consequence, have never developed, and are only rudiments of what they should be. In the classical foot the second toe is longer than the first, the third toe is the same length as the first and the fourth and fifth toes are well shaped and free from corns and spread out and take good hold of the ground when the person to whom they belong is walking. This is an exceedingly important point. Our toes should spread apart, as said before, like an animal's paws when we put our weight on the forward part of the foot in stepping out with the other foot.

There should be plenty of room in the shoe for the toes to do this, and it is largely because the toes are so tightly confined in pointed shoes and can not spread out that Americans are such poor walkers. The ridiculous high heels are unsightly and injurious and make walking difficult, yet they do not deform the foot, the most beautiful and

exquisitely designed of all our organs except our hands, to the same extent as do the short and pointed shoes so commonly worn.

So far as walking for any distance is concerned, no American expects to do that. It is because the feet are so undeveloped and their ligaments and muscles are so weak, that so many people suffer with flat feet or with weak arches. So that now, all the shoemakers are putting steel arch supporters in the shoes. This is about as sensible as it would be to support a weak arm by binding it up in splints and making it immovable, hoping that if it could not be raised, it would gradually grow strong and robust. Even a shoemaker would laugh at such a method of making a child's arm strong, and yet he boasts that he makes a weak arch strong by preventing it from taking its natural exercise. The arch of the foot must go down whenever one bears his weight upon it, and the foot must spread out. For long tramps nothing could be more painful than shoes with metal arch supporters in them. Like all these attempts to interfere with nature's methods, of which man, not to say woman, has ever been guilty, wearing arch supporters may be a cause of terrible suffering, if one has to walk any distance with them in his shoes or boots.

Of course if people walk very little, they can endure the arch supporters, just as the women endure the high heels. It would seem that ordinary boots and shoes are not made to walk in, but to look at, or perhaps to ride in.

I knew a Hebrew gentleman on the frontier who sold a man a pair of riding boots. In a few days, the purchaser of the boots came back complaining that the seams of his new boots had burst out, whereupon my Semitic friend, with a look of mingled horror and surprise, broke out with, "Why my frent, you didn'd valk in dose boots, did you? Dose was not valking boots, dey was riding boots." I often think of this occurrence when I see women trying to walk with Cuban heels and shoes far too short and too narrow for them. That their gait is singularly stilted and ungraceful every one knows, yet how they manage to walk as well as they do is surprising. I can nearly always tell by a woman's gait whether she is wearing shoes that really fit her or not. A woman properly shod may and often does show the queenly dignity and lissome grace which should characterize the most graceful of God's creatures. However, as an old walker myself I have to say that for good walking the human foot and ankle need a more thorough development than they are now allowed to attain. Every one of the ten toes should be allowed to grow to its proper size and should exert its due pressure on the ground when we walk, jump or run. The natural foot is a perfect arch, and its two columns the ball of the foot and the heel should be on an exact level, which means that the heel of the shoe should not be over a half inch in height. The heel of the shoe

should also be large, in fact, nearly as broad as the broadest part of the sole. The inside of the shoe should be three quarters of an inch longer and a half inch broader than the foot that it is meant to cover. Incidentally, people that wear such shoes and learn to take hold of the ground with their toes do not fall down and break their bones in slippery weather.

A friend of the writer's, a middle-aged man who has had his share of falls on slippery steps and icy pavements every winter, last winter escaped without a single hard fall because he was wearing low-heeled, broad-toed shoes, which the shoe-maker assured him were "a size too big for him." Here is a hint of value for stout people who are afraid to go about in slippery weather and who can not always have on a new pair of rubbers.

Just as our jaws suffer from non-development, which is the foundation of our adenoids, mouth breathing, poor digestion and mal-assimilation, not only because of our poor and irregular teeth, but because we do not get enough oxygen in our systems when we are growing for proper development, so we suffer from weak and malformed feet because these have not only not been developed by exercise, but have not even been allowed to grow to their natural size. Then we wear an arch supporter to still further cripple a weak foot and wear high heels under the mistaken impression that they keep up the instep. Of course when the arch gives way, as it often does because it is too weak to spring back after it has spread out in stepping under the weight of the body, a supporter in the shoe must be temporarily worn. Yet every effort should be made to strengthen that arch by running, walking on the toes in the bare feet, applying massage and electricity to the muscles of the calf, and toning up the general system.

The breaking down of the arch is really of more significance as an indication of general bodily weakness than as a local deformity, and its treatment should be quite as much general as local.

We shall not get perfect manhood or womanhood until we obey nature's obvious laws and allow our children's feet and jaws to develop as they were intended to do.

THE CONFLICT OF ADMINISTRATIONS

By President FRANK L. McVEY

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IN a letter to the governors of the states, at the close of the revolutionary war, Washington fervently prayed for four things, which he humbly conceived as not only essential, but actually vital, to the existence of the United States as an independent power. These four things were: an indissoluble union of the states under one federal head; a sacred regard for public justice; the adoption of a proper peace establishment; and the prevalence of a civic and friendly disposition among the people of the United States which will induce them to forget their local prejudices and policies, to make those mutual concessions which are requisite to the general prosperity, and in some instances to sacrifice their individual advantages to the interests of the community.

None of the revolutionary fathers could see difficulties other than those of a sea-coast commerce policed by many petty sovereigns. The problem of cooperation between the federal authority and the states would, in their opinion, arise only when brought to the surface by a state jealous of its prerogatives, never through the action of the federal authority. A hundred and twenty-five years have passed, and not only has the unexpected happened, but persons and corporations engaged in commerce seek the extension of federal power at the expense of state authority, if need be, in order that commerce may go on unhampered and free from restrictions of a territorial character.

Men rang the bells in steeples and gave utterance to their jubilation in loud hurrahs when King George's fleet left New York harbor. They had forgotten that a nation did not exist; that effective cooperation had ceased when Washington disbanded his army in 1783; that the union which was then dissolved existed only as a tradition, while the states were thirteen independent sovereigns, jealous of each other and open to the abuses of foreign intrigue. Thus at the beginning of the twentieth century in America has arisen a new type of problem in the conflict of administrations, solvable only by a process of cooperation.

Writing to Duane, Hamilton declared "the fundamental defect is a want of power in congress. Three causes contribute to this misfortune. In the people a jealous excess of the spirit of liberty, in congress a diffidence of their own authority, and a want of sufficient means at their disposal." "The clear duty of congress," declared Hamilton, "was to usurp powers in order to preserve the Republic, but its courage stopped

short of this solution, while the confederation as it stood was fit neither for war nor for peace."

The problem confronting the people of America in 1783 was the conversion of a voluntary league of states into a firm union. They needed to be first awakened to the necessity of organization and the adoption of a national policy; and after this the instrument of agreement must be drafted and the government established. It is not necessary at this time to discuss the detailed story of the constitution's making. From the beginning of its inception, men took opposite views as to the rights of the individual states and the nature of the powers that should be given to the central government. Those who upheld the idea of state's rights feared in their hearts the rule of the people. They argued for state representation in the national congress while maintaining that federal authority should be reduced to a minimum. The federalists, on the other hand, insisted upon a broad interpretation of the powers of the national government, thereby creating a controversy which furnished the basis of modern party relations, until materially modified by the tendency, brought about by the civil war, to discuss the import of questions rather than functions of government. The same motive, however, which caused men to turn to the states in the earlier day now causes them, in a measure, to look to the federal government, since it is believed that, in some degree at least, the rule of the people can be materially modified.

For a period of nearly thirty years after the civil war government in the United States, both federal and commonwealth, was used largely as an agency for the promotion of wealth. Special privileges came to overshadow common rights, and many problems were left untouched because in the opinion of the courts of the day the federal government had no authority over them, and the states by the constitution were not authorized to deal with such problems. But as industry has grown in immensity and spread its organization from commonwealth to commonwealth, producing a series of new problems in the movement of commerce from state to state, there has arisen a friction and questioned authority between the two branches of government in the United States. The constitution of the United States provided that the states should have all the rights of government, with the exception of the right of secession, impliedly determined by the results of the civil war, those powers which the constitution expressly confers on the federal government, and those which the constitution withholds from the states. It did not take many years for shrewd lawyers to discover that there existed in the interpretations of the two court systems a "twilight zone," as it has been picturesquely put by one of America's party leaders.

The specific powers of the federal government were determined narrowly, while the general powers of the state were interpreted specif-

ically. There arose, as a consequence, certain types of problems, certain species of acts, to which no special law seemed to apply, which left their authors in the possession of concerns working in a no-man's-land. To meet this serious difficulty it has been proposed on one side that there shall be a marked increase of federal authority which will deal with all such problems, and on the other there has been insistence that the sanctity of the constitution shall be maintained, the sacredness of the judiciary upheld, and the doctrine of the division of powers kept intact.

Those who believe in an increase of federal authority have maintained that the union is a federal one, that the sovereignty of the states never existed, and that with their present authority and power they are merely nuisances clogging the way of the federal government. There is no question that a series of difficult problems have arisen which demand a wider interpretation of federal authority, but the attitude just mentioned would result in the reduction of the states to mere local administrative units with no more power and authority than that possessed by a county or township. It is declared that the conservation of resources is so important that state lines ought not to be taken into consideration in dealing with the problem, while interstate commerce and the questions that are associated with it make it impossible, if we are to be a great commercial nation, to recognize that state authority over commerce and trade exists within certain boundaries.

Such, briefly stated, is the controversy; in its final solution the whole theory of American government is carried with it. In the course of the discussion it will be necessary to examine some of the experiences and outcomes of federal legislation, and to present, if there be any other point of view, what can be done in the development of cooperation between the two branches of government rather than subordination of one as compared with the other.

Over and above every other problem of a national character, in its importance from the point of view of the public, stands, in all probability, that of interstate commerce. The legislation and various attempts at legislation in this connection cover a period of forty years. In the year 1872 Mr. Regan, a congressman from the state of Texas, presented a bill regulating interstate commerce carried on railways. The bill was the outcome of grievances and difficulties arising from the attempts of the various states to secure some betterment of transportation facilities, lower rates and better methods of carrying on the business. Annually for more than fifteen years this bill made its appearance in congress, and it was not until 1887 that the interstate commerce act was passed regulating railroads and railroad rates. Despite the complaints that were made regarding the inefficiency of this law, and the difficulty of bringing under it many of the problems that arose, no other legislation took place until the year 1903, and since then the law has been modified in 1907 and 1910.

If we turn to the national bank act, which has been referred to many times as one of the most beneficent laws that the federal government has put upon the statute books, it will be noted that it had its origin in the necessities of the civil war, that it was developed as a revenue measure in the hope of forcing the banks of the day to buy the bonds of the distressed government. The principles which were recognized by the secretary of the treasury at the time as essential to the establishment of a banking system were taken in part from the experiences of Massachusetts and New York. Out of these came the right of free banking, the principle of the redemption fund, and the issue of paper money upon a bonded security, as important parts of the national bank act.

Passing in quick review the federal legislation relating to pure foods, it will be found that not until 1906 was any legislation secured which authorized the inspection and examination of foods by federal officers and placing upon adulteration an adequate penalty. For seventeen years the people of the nation had urged congress to pass a bill that would meet the many abuses that had arisen in the adulteration of food and dairy products. The same story can be told about the tariff. Since the civil war the different tariffs that have been enacted for the purpose of protecting manufacturers in the United States have steadily increased, and the percentage of the burden laid in the form of customs duty, regardless of the conflict of interests and the necessities of the consumer, has steadily augmented, until under the provisions of the McKinley bill it stood at a higher percentage than at any time in the history of the nation.

Nor is this all. The encroachments upon the financial strength of the states, in the form of added taxes, have come with the growing activity of the federal government, as might well have been expected. In the year 1909 the federal corporation tax was laid upon all corporations engaged in interstate business in the United States. It has been urged that a large revenue would be secured by this form of tax levy; that it would give greater control over the many corporations of the country, making it possible to reorganize their book-keeping and accounting systems along the lines of the best principles of accountancy. The law has now been in existence about two years, and it has been shown clearly that it lays a heavy burden upon corporations in the impossible demands of the accounting methods required, while the principle of self-assessment, now unchecked by government examination, leaves it practically with the corporations to determine what they shall pay. But the worst side of the corporation tax is that the fiscal system of those states that have developed such a plan of taxation is materially affected. These states find that their own sources of revenue are cut into, while the corporations subject to this fiscal control are provided with an argument of double taxation against proper state taxes. This phase of the corporation tax has been regarded by many economic

authorities as unfitting the tax for use by the federal government, and its application has been denounced in many quarters as an invasion of the proper field of state taxation.

In the efforts now being put forth to establish a federal income tax the same tendency is to be seen. While it can not be denied that the federal government should have the authority in time of need to levy a federal income tax, yet it is distinctly questionable as to the wisdom of such a tax in time of peace for federal purposes. The problems which confront the states at the present time are indeed serious. Upon them fall all of the burdens of maintaining local government, and these, with the growth of wider ideas regarding the development of society, constantly tend to increase rather than diminish. The states are now called upon to develop extensive educational systems, to care for the insane, to punish criminals, to maintain courts, to preserve order, to build roads, and support the poor, besides erecting public buildings, and in the municipalities providing water, light, paving and the other necessary improvements of modern towns and villages. To have the federal government, therefore, step aside and reach out into the states for additional funds for federal support means interference with the states' fiscal systems and in the long run the weakening of their financial power. In the customs duties and the internal revenue, the federal government has every facility to secure sufficient revenue for the conduct of its business.

What has already been said regarding the history of federal legislation in connection with the interstate commerce act, the national bank act, the pure food and dairy legislation, and the tariff indicates clearly the slowness with which congress meets the problems of legislation, and how difficult it is to secure modification of a law by a body so overwhelmed with legislation for a country as big as America. In nearly every instance the states began the legislation, and carried it forward to a point where it was necessary to look to congress for some wider interpretation in order that relief might be given. The work which congress has done, while commendable in many cases, shows clearly that it can not act intelligently in every instance because of its distance from the problem, and that while it does work out in general some specific lines of action, it can not by the very nature of things meet local needs.

Sixteen years after the introduction of the Regan bill came the interstate-commerce act, and for as many more no modification of the law was made, despite the insistent demands for such changes. The national bank act remained practically unchanged after the date of its passage until the year 1900. Examples of this kind go to show that federal legislation is attended by many disadvantages. Undoubtedly congress can deal with large problems on general principles, but on that very account it is often unwise for it to attempt to work out experiments and changes in the law.

It is just here that the states come to play an increasingly important part. They are in fact laboratories in which industrial and political experiments can be worked out on such a scale as to determine the value of the experiment. It means the relieving of the nation as a whole from many of the pangs necessary in the growth of democracy. It means the utilization of the best that comes from such experiments and the saving to the government of the loss of time and disappointment in carrying on large enterprises. The states have, as a consequence, an important governmental function to carry out. They are not to be regarded as mere administrative units, subject to the direction and domination of a federal authority thousands of miles away, with no autonomy such as is found in the case of the departments in France; but they are rather constituent parts of the union, self-directive, and capable of maintaining their own autonomy and of carrying on their own functions within their own boundaries. To them we entrust our daily welfare, while to the federal government are turned over our collective interests. Nevertheless, they are one and the same government, each a part of its frame, working together, but separately organized. To substitute one for the other is to violate the whole principle of the federal scheme.

The conflict between the two is more apparent than real. The difficulties of the situation have been materially exaggerated, and not always without a purpose. In the early history of our nation many of the believers in state's rights took that position because of their feeling that the government would not then be in the hands of the people, but would be only representative, and to-day that same feeling exists in the demand that the federal authority be enlarged and the states reduced to minimum power in order that again the authority of the people may be hampered and limited. Much confusion of detail and of procedure clouds the issue. Underlying it all, the principle of action, both in state and federal government, is the same. The law is founded on the common law of England, and there is to be discovered to the diligent inquirer a greater uniformity than diversity. The extent of this uniformity is marvelous. From one state to another have been handed on the principles of legislation and forms of government. In one state is initiated some new phase of political organization, its propagation is carried on into another community, and little by little there moves constantly over the land an increasing uniformity of legislation. While it may be said that as a nation we are face to face with serious industrial problems over which we have no central authority, nevertheless the nation has made some progress under present constitutional provisions and the states are diligently seeking legislation from other sources that will meet the difficulty. The danger is not from this direction, nor is it likely to arise from our failure to solve the problem in a fairly satisfactory way through the utilization of both state and federal governments, but the danger, if from anywhere, is from a

tendency seen now and then towards excessive centralization. It is not, however, from tyranny that we are likely to suffer, but rather from a breakdown in an organization too extended and too difficult of effective operation. There can be no question in the minds of students of political history that the future of the nation depends upon the cooperation of the governmental units rather than upon the exaggeration of one of them. Instead of attempting to magnify the federal government, there ought to be a marked movement toward the equalizing of the functions of both. Because of the extending of its authority over a large area, the federal government is in a position to secure information on all topics for utilization in the various states. An instance of this statement is found in the collection of data already undertaken by the different bureaus at Washington. With the authority of the national government behind them, they are able to bring together an immense amount of data that throws light upon many questions. To limit the functions of the federal government to the mere collection of data is not in the mind of any one. A second step could be taken, one that is already being carried on, through the medium of investigation. Thus the collection of data should be supplemented by specific investigations of various matters of interest to the public welfare. Again this alone is not sufficient. Such information must be given publicity, and here the federal government is in a position not only to give wide publicity to its own actions and the results of any investigations which it carries on, but is in a position to insist upon publicity on the part of all interstate corporations. Because of the conflict of authority in the field of commerce many suggestions have been made from time to time by which the federal government is to take over full authority in the matter of incorporating such corporations. It is urged in behalf of this movement that many of the states now permit the incorporation of companies under peculiarly satisfactory provisions for the company, and that as a consequence the other states are not able to control them. There is considerable truth in this position. But the matter is comparatively easily disposed of. There is no reason why congress should not pass an act setting forth the conditions under which any corporation may engage in interstate commerce. These conditions would have reference to capitalization, publicity of accounts, and responsibility for any statements set forth regarding their business. Such a law would in no way necessitate incorporation or the disturbance of the incorporation of companies by the different states. But like the tax upon bank currency passed in 1866, it would have a marked effect in forcing corporations to comply with the federal conditions, while at the same time allowing the states to modify the law so as to apply to the conditions peculiar to their own territory.

Many other instances might be cited in which the same relationships are to be found as in the case of the interstate corporations. The more

one studies the situation, the more one is impressed with the fact that the relations between the states and the federal government can be strengthened rather than weakened by the passage of laws on the part of congress which will set forth the conditions under which business concerns can enjoy the privileges of carrying on their traffic between the different states, allowing the regulations to be developed by the commonwealth. It might be argued that this would still retain the worst features of present conditions, without discrimination and with lack of uniformity. But an examination of the laws of the states will confirm the impression that the states are very rapidly taking over those regulations and laws which have been proved by the test of time to be satisfactory and efficient. Any limitations of the authority of a state like Wisconsin, where under the direction of an underlying public sentiment much progress has been made in working out a number of highly efficient methods of dealing with serious questions, would be unwise. It is very doubtful if the same progress could have been made by the federal government through the medium of legislation by congress.

The people of this country are interested in efficient administration. They are not insistent upon either federal or state authority as such. What they want to see is progress in dealing with some of our serious national questions. But history proves that when a nation tries to cover too large a field and through its national legislative body to deal in detail with local questions, it fails to accomplish the result that was expected. In America we have a very fortunate division of functions, at some points weak, but on the whole a satisfactory division of authority. To push the states down into the position of mere administrative units would result in the weakening of the whole plan of government and in a probable inefficiency because of the distance from central authority in dealing with governmental matters.

Our attitude, then, in this great question of the conflict of administrations should be that of seeking for the full utilization of both federal and state authority, for the elimination of friction between them, and for the securing of an adequate working plan by which both can be used to the best advantage. We are a nation of one people, believing distinctly in the federal form of government. It remains, therefore, for us to insist upon a clear understanding as to the functions of the federal government and a larger realization of the fact that the states are carrying the burden of the expense and difficulties of local problems, and that interference on the part of the federal government is likely to result in an increasing weakness of authority rather than a strengthening of government.

A century and a quarter have passed since the creation of the republic in 1787; the indissoluble union so fervently hoped for by the father of his country is now an accomplished fact; though the regard for jus-

tice can hardly be referred to as high, nevertheless the nation is making progress steadily toward more efficient courts; our peace establishment meets the needs of the republic; and great advance has been made toward the civic and friendly disposition among the people of the United States, sufficient to induce them to forget their local prejudices and policies enumerated by Washington as the fourth desideratum. We have still the problem of federal authority and the wise determination of what and how far the government should attempt to rule by central authority. The question is of vast importance; its determination will have much to do with the perpetuation of the republic.

RELATIONS OF JAPAN AND THE UNITED STATES[1]

By President DAVID STARR JORDAN
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IT is now nearly sixty years since the modern history of Japan began. The arrival of Commodore Perry at Kurihama, the downfall of the Shogun and the restoration of the Mikado mark the point of transition from feudal Japan to the Japan of to-day.

In all this period, the Japanese nation has been the subject of intense interest to the cultivated people of America, and a warm sympathy has arisen between those people of each nation who have come to understand the character and the ideals of the other. This sympathy has been kept alive by the influence of Japanese students in America, on the one hand, and on the other by the interest of those who have gone as missionaries, as teachers or advisers in the affairs of Japan.

In Asia there has existed for many years a division of the non-Japanese into two sharply defined parties, or one may say, attitudes of mind, the pro-Japanese and the anti-Japanese. The disputes of these two types of people have not come to our notice until very lately. Till within the last decade, American influence was almost wholly ranged with the pro-Japanese. Contributory to this fact was our general tendency toward sympathetic interest in a nation which rose to constitutional government through influences from within. The Shimonoseki incident, the visit of General Grant, the aid of the United States in setting aside the obnoxious consular jurisdiction in the treaty ports, all these became expressions of the friendly attitude of America.

The Japanese question, as it is now called, first rose to the horizon in 1899, the year of the abrogation of consular jurisdiction.

The needs of cheap labor on the sugar plantations of Hawaii was great and constant. Kalakaua, the king, had tried to meet this need by "blackbirding" expeditions among the islands of Polynesia. The steamship companies followed by strenuous efforts among the laborers in the rice fields of the region about the Inland Sea of Japan, the districts of Okayama, Hiroshima and Yamaguchi. By their insistence and by offers of real wages their emigration agencies brought to Hawaii many men from the lowest stratum in Japanese life, next to the criminal and the outcast—the unskilled and homeless laborers in the rice fields. These have been called coolies, but their position in Japan was

[1] Abstract of an address at Clark University.

quite different from that of the coolies, the half slaves, of the continent of Asia.

These laborers were treated essentially as slaves in Hawaii. They carried with them none of the culture of Japan, they received none in their new homes. They did not go as colonists. The Japanese with homes do not willingly leave these homes where "their own customs fit them like a garment," to form new ones in another region. The Japanese are not spontaneously colonists. They will go to other lands for study or for trade or for higher wages. But they go with the hope to return. The coolies went to Hawaii solely under the incentive of higher wages. When Hawaii was annexed to the United States the shackles of their slavery was thrown off, and the same impulse of higher wages carried them on to San Francisco, Seattle and Vancouver.

In 1899, Mr. W. W. Scott, of Honolulu, a former resident of Japan, warned the Japanese authorities of the dangers involved in this movement of Japanese laborers to California. Their lower standard of living and of wages would make them exploitable. This would bring them in conflict with labor unions. Economic clash would beget race prejudice, and Japan could not afford to be judged by her least attractive and least efficient representatives. Influenced by these and similar considerations the Japanese government in 1899 refused passports to all unskilled laborers, and since that time none have come from Japan direct to the Pacific states.

But in response to the continuous demand of Hawaii they were for a time allowed to go there. Japanese people already constituted the great majority of the population of these islands. Even after passports were refused to laborers going to Hawaii, the immigration of coolies from Hawaii to San Francisco still continued.

There was and is a very great demand for Japanese help among the orchardists of California. No other labor has been adequate and available and it is not easy to see what the fruit interests are to do without Japanese help. In this work the European laborer has scarcely entered into competition. The prices paid the Japanese are not less than the wages of American labor in the same lines. The demand for Japanese workers in household service and in canning establishments has also been great and unsatisfied.

From the fisheries which the Japanese have almost monopolized in British Columbia and in Hawaii, they have been virtually excluded by statutes limiting the fisheries of California, Oregon and Washington to citizens of these states. Unless born in the United States the Japanese can not become citizens.

A large portion of the Japanese laborers avoided the orchards and established themselves in the cities where, as laundrymen, restaurant

keepers, draymen, carpenters and the like, they entered thus into competition with the American laborers, the most of whom in San Francisco were recent immigrants from Europe.

Their lower scale of living and their peculiarities in other ways soon brought them under the condemnation of the trade unions. Anti-Japanese societies were formed and much effort was spent to the end of the exclusion of Japanese and Korean laborers as the Chinese had already been excluded. The personal violence which accompanied the anti-Chinese campaign of twenty years before was practically absent from this. The Japanese were better able to take care of themselves and also, in spite of much reckless talk and exaggeration of language, there was very little real enmity toward the Japanese with any class of their opponents. Most of the unfriendly talk was for political purposes and the main cause of opposition was economic.

An exclusion act like that directed against the Chinese could not be considered by our government. It would be a needless affront to a friendly nation, and a nation willing to do anything we may desire, provided it could be done with dignity. The Chinese exclusion act finds its excuse perhaps in the fact that China is not yet a nation. No absolute monarchy can be a nation, in the modern sense. When China finds herself at last, this exclusion act must wholly change its form.

In this condition of affairs, a definite agreement was made with the Katsura Ministry of Japan, that no passports for America were to be issued to Japanese laborers, that the responsibility for discrimination should rest with Japan, and that all holders of Japanese passports should be admitted without question. This agreement has been loyally and rigidly kept by Japan. A bit too rigidly, perhaps, for it is growing increasingly difficult for Japanese students to come to America. The diffusion among our American universities of Japanese students, eager, devoted and persistent, has been one of the most important factors in maintaining the mutual good will and good understanding of the two nations. For everywhere these Japanese graduates of American universities give a good account of themselves, standing high in the estimation of their people at home, while retaining a keen interest and intelligent sympathy in all American affairs.

The present settlement of the immigration question is the very best possible, so long as restriction of any sort is regarded as necessary. It is in the interest of both nations and of all concerned, and the occasional efforts to supersede it by a general "oriental exclusion" bill are prompted by no consideration of the public welfare.

To be grouped with the inchoate nations of Asia as "orientals" is particularly offensive to the proud, self-governing Japanese. In their thoughts and ambitions, in their attitude towards peace and justice and

toward modern civilization, the Japanese are in full harmony with the nations of Europe. It is their mission to bring modern civilization to Asia. This they are literally doing in Korea, one of the most interesting experiments in the reclamation of a dying nation undertaken in modern times, comparable to our sanitation of the Canal Zone of Panama. At the same time, the hold of Japan on Korea, like our hold on Panama, rests on the right of arbitrary seizure.

The main justification of the exclusion of Japanese unskilled laborers must be found in the economic conditions on the two sides of the Pacific. It is our theory in America that there should be no permanent class of unskilled laborers, and that it is the duty as well as the right of every man to make the most of himself.

In most other nations, a permanent lowest class which must work for the lowest wages and do the menial service of society is taken for granted. This theory is affirmed in the Chinese proverb, "Big fish eat little fish, little fish eat shrimp: shrimp eat mud." It is no part of our policy that shrimps should remain shrimps forever. Cheap labor is exploitable to the injury of labor of a higher grade. There is then a degree of justice in the contention for the exclusion of the cheapest and most exploitable type of laborers, whatever their race or the country from which they come.

There is also legitimate ground for fear that a wide-open door from Asia would crowd our Pacific coast before the natural population of America has found its way there. Such a condition would add to the economic wealth of the coast at the expense of social and political confusion.

Many honest men fear the advent of large numbers of Japanese as likely to provoke racial troubles similar to those which exist in the south. I do not share this opinion. No race is more readily at home in our civilization than the cultivated Japanese. That the rice-field coolie does not assimilate is because of his crude mentality and his lack of any training, either Japanese or American. This is broadly true, though among these people are many of fine instincts and marked capacity. The condition of mutual help and mutual tolerance in Hawaii shows that men of a dozen races can get along together if they try to do so. The problem of the south is the problem of slavery; the problem of the half white, the man with the diverging instincts of two races, this status changed in an instant, by force, from the position of a chattel to that of a citizen. It is the problem of the half-white man given political equality when social equality is as far away as ever. No bar sinister of this sort nor of any other kind separates the European from the Japanese.

Social reasons for exclusion have a certain value. The Japanese are the most lovable of people, which fact makes them the most clan-

nish. They have the faults of their virtues, and the uneducated Japanese sometimes show these faults in unpleasant fashion.

There are still more urgent reasons why the Japanese themselves should insist on exclusion of their coolie laborers from Canada and the United States. The nation can not afford to have America know it by its least creditable examples. A hundred Japanese rice-field hands are seen in America, to one Japanese gentleman. Thousands of men who never knew a Japanese merchant or artist or scholar have come in contact with Japanese draymen or laundrymen. They have not always found these good neighbors. The present conditions are not permanent, perhaps, but as matters are to-day it is to the interest of Japan, even more than to the interest of California, that the present agreements should be maintained.

Just after the Russian War, when America's sympathy was almost wholly on the side of Japan because the attitude of Russia was believed to be that of wanton aggression, a series of anti-Japanese articles were published in various American newspapers. Who wrote these articles and who paid for them, I do not know, but their various half-truths and falsehoods had an unfavorable effect on American public opinion. All sorts of half-forgotten slanders were revived and followed in their wake. Among these is the ancient falsehood that Japanese banks employ Chinese tellers because they can not trust their own people. Of all the banks in Japan only one, the Yokohama Specie Bank, which does a large Chinese business, has ever had a Chinese employee.

The school affair in San Francisco was also unfortunate, although in itself of no significance whatever. In the great fire of 1906, the Chinatown of San Francisco was entirely destroyed. After the fire a temporary schoolhouse was established in the neighborhood. There were no Chinese children in this school and the teacher, perhaps fearing loss of position, asked the School Board to send the Japanese children in the neighboring region to her. The School Board, apparently ignorant of possible international results, formed of this an "Oriental School." There were no Chinese children concerned, nor is it at all clear that Japanese children would have suffered even had such been present.

Under our treaty with Japan our schools, as every other privilege, were open to Japanese subjects on the basis of "the most favored nation." To send Japanese children to an "Oriental School" was probably a violation of this clause of the treaty. It is not certain that this was a violation, but it appears as such on the surface. So far as I know, there has been no judicial decision involving this point. In any case, the apparent remedy lay in an injunction suit, and in a quiet determination of the point at issue. It was a mistake, I believe, to make

it a matter of international diplomacy. Neither the nation nor the state of California has the slightest control over the schools of San Francisco, unless an action of the school board shall traverse a national or state law or violate a treaty. A treaty has precedence over all local statutes. But the meaning of a treaty can be demonstrated only through judicial process.

The extravagance of the press in both nations stirred up all the latent partisanship in both races involved. On the one hand the injuries to the Japanese children were grossly exaggerated. On the other hand, gratuitous slanders were invented to justify the action of the school board. This action was finally rescinded at the request of the President of the United States, who uttered at the same time a sharp reprimand to the people of California. This again was resented by the state, as only five of its citizens were responsible for the act in question, and the people of the state as a whole had no part whatever in anti-Japanese agitation nor any sympathy with the men temporarily in control of affairs in San Francisco. The net result of the whole affair was to alienate sympathy from Japan. This again was unfair, for the Japanese nation as a whole had no responsibility for what, at the worst, was an error of judgment on the part of a few of its immigrants.

Since this affair was settled I have not heard a word as to the relation of the Japanese to the schools of San Francisco, and I presume that this difficulty, like most others, has disappeared with time and patience and mutual consideration. It is not likely to be heard from again.

Only a word need be said of other matters which have vexed the international air. War scares are heard the world over. The world over they are set going by wicked men for evil purposes. In general the design of purveyors of international slanders is to promote orders for guns, powder and warships. There are other mischief makers, who hope to fish in troubled waters.

A few years ago it was suggested in America that the Manchurian railways, built on Chinese territory, by the governments of Russia and Japan should be sold to China. To this end China should borrow the money of an international syndicate under whose authority the railways should be managed. This line of action was for various reasons impossible to China. The suggestion itself was very unwelcome to the Japan authorities as well as to the Japanese people to whom the leased land between Port Arthur and Mukden is hallowed ground, holding the graves of a hundred and thirty thousand of the young men of Japan. The suggestion itself was personal only. It was never acted upon, never approved by the American people, no official action was ever based upon it, and it should not be a subject of worry to either Russia or Japan.

The fur seal question has been under discussion for more than twenty years, ever since the wanton killing of females at sea first threatened the destruction of the Bering Sea herds. By the pelagic sealing of Canada the number of breeding seals in the Pribilof herd was reduced from about a million to about 180,000. The entrance of Japan into Bering Sea, for the protection of the herd, disregarding the regulations of the Paris tribunal, inadequate as these were, soon reduced these numbers to about 30,000. Last year, a treaty was concluded, Russia, Japan, Canada and the United States being parties to it, by which the matter was honorably and justly settled and the continuance and restoration of the three herds, American, Russian and Japanese finally assured. There is not now a single cloud above the official horizon as between the United States and Japan. There have never been any real difficulties and the apparent ones are no greater than must appear wherever great nations border on each other. As the Japanese are fond of saying: The Pacific Ocean unites our nations. It does not separate.

War talk on either side is foolish and criminal. Japan recognizes the United States as her nearest neighbor among western nations, her best customer and most steadfast friend. Her own ambitions and interest lie in the restoration of Korea, the safeguarding of her investments in Manchuria and in the part she must play in the unforetold future of China. For her own affairs she needs every yen she can raise by any means for the next half century. For the future greatness of Japan depends on the return of "the old peace with velvet-sandalled feet," which made her the nation she is to-day.

War and war demands have made her, for the time being, relatively weak, she who once was strong in her persistent industry, her unchanging good nature, her spirit of progress, her freedom from debt and in the high ambition of her people. Thirteen hundred millions of dollars in war debt is a burden not lightly carried. Through peace, and peace only, Japan will gain her old strength, and none know this better than the men of the wise and patriotic group who now control Japan.

SOME INTERESTING CHARACTERISTICS OF THE MODERN ENGLISH LANGUAGE

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MODERN English possesses not a few characteristics of great interest from a psychological as well as from a merely philological point of view. This is especially true, if one considers the possible culmination of our mother-tongue as the world-language. For some of these traits are the very ones which seem fitted to enable English to survive in that rôle. They are matters connected with flexibility; correspondence with thought instead of subordination of it to grammatical categories and merely formal canons; power over words unknown to other tongues, where freedom in accepting foreign terms and liberty to "reduce" unnecessarily cumbersome expressions are often unhappily much restricted; absence of fear of hybrids and certain other misgivings of the "purists" and pedants. Altogether, English is a living language, master over both grammar and dictionary, and exceedingly skilful in its use of this sovereignty. But a few of these important qualities of modern English can be considered here.

1. *Foreign Words.*—The free adoption of foreign terms of all kinds is one of the most striking evidences of the real vitality and essential cosmopolitanism of modern English. Its vocabulary always has "the open door." It admits on the same conditions a word from Ojibwa or from Greek; one from Latin or from Polynesian. If the right word turns up at the right time, there is no Academy to pass judgment upon it, grammatically or lexicographically. The sole authority to welcome or to reject is the genius of the language itself. *Tammany* and *telephone, taboo* and *aeroplane,* all come into our common speech with equal rights to citizenship. English is thus dependent upon no one language, or even set of languages, for the accretion of its vocabulary. It can pick and choose wherever it will; no linguistic market is ever closed to its traffic. No one language, however polished, however important in the past history of the world, however highly esteemed by educators or approved by men of science, can assume the rôle of dictator here. The balancing of its draughts upon the classic languages with those upon insignificant or unknown barbarian tongues and dialects is a marked feature of the mother-tongue. English lets the psychological moment dominate; the needs of the time outweigh the prohibitions and the circumscriptions of the pedant. Thus Greek gave us *ostracise,* but not

the more living *boycott;* we owe to it *democracy, oligarch, aristocracy, tyrant* and *politics,* but we have borrowed from the American Indians *Tammany, mugwump,* and perhaps *caucus;* nor has anthropological science any greater words to conjure with to-day than *totem* and *taboo,* the first of which is derived from an Algonkian language of North America, and the second from one of the Polynesian dialects. To create *sociology,* a hybrid of Greek and Latin that shocked the purists was called into being, but the very useful and significant term *club* was taken from a cognate Scandinavian language. The familiar word *squirrel* goes back to Greek, but *chipmunk,* in spite of its rather deceptive appearance, is derived from the Ojibwa dialect of the Algonkian Indians. The Latin ending of *petunia* can not altogether disguise its ultimate origin from one of the Tupi-Guaranian languages of aboriginal Brazil. *Megatherium* is Latinized Greek, but *mammoth* is little changed from the form it had in a Tatar language of Siberia. The vocabulary of English owes much to Greek and Latin, but this debt does not include terms like the following, which have all become part and parcel of everyday speech: *Slave* (Slavonic) and *nabob* (Hindi); *talk* (Lithuanian) and *jungle* (Sanskrit); *thug* (Hindustani) and *bantam* (Javanese); *gong* (Malay), *tattoo* (Tahitian) and *guinea* (W. African); *alcohol, assassin,* and *tariff* (all Arabic); *buccaneer, cannibal, hammock, hurricane, mahogany, potato, tobacco, tomahawk, wigwam* (all from the various Indian tongues of the New World). What list of the important loan words of modern English could omit *Tammany, mugwump, totem,* etc.? And what place-name of classic origin has, in the present day and generation, been given new life and significance in our tongue, like *Chautauqua,* one of the remembrancers of the Iroquoian predecessors of the white man in the great state of New York? Another place-name from the same source, *Saratoga,* has also won lodgment, but with less fame and repute. In American English, in particular, the only memorial existing of some now extinct and forgotten tribe of savages may be some such word which has won a place in our hospitable lexicon. On the other hand, the united efforts of all the "purists" in the land are often insufficient to secure permanent footing for some new coinage, whose classical parentage is quite unimpeachable and whose grammatical attire forbids criticism. Very often does our language illustrate the truth of the old saying, "the first shall be last, and the last shall be first." It is a democratic institution, having adopted a declaration of independence against King Grammar and his whole court.

2. *Hybrid Words.*—English has no morbid fear of joining its words together regardless of the remoter origin of the newly-wedded elements. It is a language in possession of those who use it, and not one in perpetual and cringing serfdom to grammarians and lexicographers. It shows its genius in its independence of these linguistic tyrants, being

the most untrammeled and democratic tongue ever linked to an advanced and progressive type of human culture. When the term *sociology* was first introduced, narrow-minded classicists and other would-be guardians of the purity of the language objected that, since it was not composed of two Greek or of two Latin elements, but happened to be made up of one part Latin and one part Greek, it could not be admitted into the vocabularly of modern English. But how many "pure" words have filled forgotten graves since it was born! And this is but one example of the attempts to make the classical tail wag the English dog. Did English tolerate no hybrids, we should be without *Christmas, dislike, grateful, pastime, becalm, dishearten,* and many more of our common words. And where were the "purists" and the classicists when, in response to the needs of the political or the scientific moments, as the case might be, *anti-Tammany, near-genius, re-tattooing, pre-totemic, pseudo-mugwump, semi-taboo* and other interesting terms came into being? Hybridity is no efficient scarecrow for such a tongue as modern English. A fair field and no favor is now the law of survival and entries are welcome from all sources, known or unknown. The satisfying term that appears at the psycholgical moment has to undergo no *recherche de paternité.* English possesses some most remarkable hybrids—an example or two must suffice, here.

a. Remacadamizing.—In English one may speak of "remacadamizing" the road or, using the word as a noun, of its "remacadamizing." It is certain that no other language in the world can boast a word of such mixed and varied hybridity. *Remacadamizing* resolves itself into the following components: (1) *re-*, a Latin prefix, signifying "a repetition, or doing over again"; (2) *mac,* a Gaelic word for "son," in common use as a prefix for genealogical purposes; (3) *Adam,* the representative in a number of European languages (including Gaelic and English) of the Hebrew name of the first man, according to the Mosaic account of the creation as given in the first book of our Bible; (4) *-iz* (or *-ize*), the modern English representative, through French *-iser,* of the Greek verbal terminal *-ιζειν*; (5) *-ing,* the English suffix of the participle present, verbal noun, etc. The word *remacadamizing* thus represents five languages: Latin, Gaelic, Hebrew, Greek and English. The "root" (*macadam*) of this word exhibits also in another way the vitality of our English speech and its ability to draft new words into its vocabulary, whenever the need arises. The term *macadam* is really the family name of the man, *John Macadam,* who, in 1819, devised the well-known method of paving roads with small broken stones, etc. Celtic and Semitic had already combined to produce *Macadam,* "son of Adam," which the English language then took up and further molded to suit its genius.

b. Siouan.—When the late Major J. W. Powell, the anthropologist,

in the last quarter of the nineteenth century, drew up his classic list of the linguistic families of American Indians north of Mexico, he adopted as a suffix for each stock-name the convenient *-an*. One of the families thus constituted was the *Siouan*, embracing all the tribes cognate with those already known as *Sioux* or Dakota, etc. Now *Sioux* is in English a loan-word from Canadian-French, being really a "reduction" or abbreviation of *Nadowessioux*, which is found in varying spellings in the latter part of the seventeenth and during the eighteenth century in the writings of travelers, etc., of French nationality or extraction. *Nadowessioux*, itself, is a corruption of *Natoweisiw*, literally, "he is a small rattlesnake" (of the massassauga variety), a term applied, in the sense of "enemy" to Indians of the Siouan stock by their Algonkian neighbors, such as the Crees, Ojibwa, etc. The word *Siouan* turns out thus to be a very curious hybrid, to the formation of which the Cree-Ojibwa, French and English languages have contributed. *Natoweisiw* is composed of *natowé*, "snake," and the compound suffix *-is-iw*, which serves to give the word its special meaning. In Canadian-French the termination was corrupted into *-ssioux*, since the word was conceived of as a plural and given the sign of the plural in French *-x*. By and by the word *Sioux* appears as the representative of the longer term *Nadowessioux*, and so made its way into English, where also it was regarded as a plural. The word *Siouan* exemplifies, in a different way from *remacadamizing*, but quite as interestingly and just as remarkably, the genius of the English language in the evolution of hybrids. This characteristic, like its readiness to adopt foreign terms, is aiding English more and more in its candidacy as a world-language.

3. *Prefix and Suffix.*—There exist in the world languages that use prefixes only, others that know only suffixes; and there are also many that employ both these morphological devices. Few, like modern English, are free to use the very same particle as both prefix and suffix. And it is one of the complaints of foreigners that expressions of the type of "set up" and "up set" are often very far from being identical in meaning—indeed, may have no kinship in signification whatever. But this fact is a character of strength rather than of weakness, in a language such as ours. We can say: *aftermath* and *day-after; aforetime* and *pinafore; overalls* and *allover; overdo* and *do over; overlook* and *look over; overpay* and *pay over; overtake* and *take over; overwork* and *work over; inset* and *set in; intake* and *take in; instep* and *step in; onset* and *set on; outlay* and *layout; outlook* and *lookout; outworks* and *work out; by-gone* and *passer-by; undergo* and *go under; understand* and *stand under; uphold* and *hold up; upstart* and *start up*, etc. A study of the meanings of the words just cited will demonstrate that English has still a fertile field in this direction. It has been pointed out by the

cynically minded that *uphold* and *hold up* (in the colloquial sense of robbing on the highway) are just about opposite in their significations. A similar perversity of meaning attaches to the suffix use in such expressions, in colloquial use, as *take in, do up,* and some others. But it is such flexibility, nevertheless, that gives the language a powerful advantage over all other modern or ancient forms of speech. In English, too, a prefix or a suffix can, upon occasion, become an independent word. Thus we may speak of "isms" and "ologies"; and of "ana," derived from the termination of Shakespeariana, etc.

4. *"Reduced" Words.*—Another noteworthy characteristic of modern English is its capacity to "reduce" words of inordinate or unnecessary length—a sort of evolutional monosyllabism, as it were, in many cases. The *phone* and *bike* of the street to-day are kin of the dictionary terms *cab* (for French *cabriolet*) and *mob* (for Latin *mobile vulgus*), *bus* (for *omnibus*), etc. In America *Jap,* for *Japanese,* seems common to newspaperdom and occurs sometimes elsewhere. Slang and the special jargons of classes, professions, etc., of course, count such "reduced" words by the score. One place where the process is clearly seen at work is in the case of words and place-names adopted from American Indian languages. Thus, if Dr. J. H. Trumbull be right, the Algonkian *toboggan* has, by way of *Tom pung,* produced *pung,* the name of a well-known vehicle in New England; and the Indian *Quaquanantuck* in Long Island has been "reduced" to *Quag; Sagaponack* to *Sag,* etc. More than one "*Hog* Island" on the New England coast is perhaps all that represents, by way of *quahog,* the Indian word seen in the Narragansett name of the round or hard clam, *poquauhock.* Other "reductions" of words of Indian origin are: *Cisco* or *sisco,* which is all that is left of the Ojibwa name of this fish of the Great Lakes, *pemitewiskawet,* corrupted by way of Canadian-French; *longe,* or *lunge,* from Ojibwa *maskinonge*—the longer term being also in use; *coon,* via *raccoon,* from a Virginian Indian *arakunem,* or as Captain John Smith spelled it, *aroughcoun;* etc. In most of these cases the "reduction" has occurred at the beginning of the original word. Examples of "reduction" in which the terminal part in more or less mutilated form has survived are: *Squash,* which represents the Narragansett *askutasquash,* the name of this vegetable, of which we meet also another early form, *squontersquash,* keeping nearer the original; *hickory,* from the *pawcohiccora* (as the old writers give it) of the Virginian Indians. It sometimes has happened that in one part of the country the first part of an Indian word has survived in "reduction," and in another the last. The Narragansett-Massachusetts *scuppaug* has produced in Rhode Island, etc., *scup,* and in some other places, perhaps *pogie* or *paugie;* and *poquauhock* has given in Nantucket, etc., *pooquaw,* and elsewhere *quahog, cohog,* or even *hog.* Some of the words in our English dic-

tionary, concerning whose etymology little or nothing is known, may have originated in somewhat similar fashion. The "back-formations" of Dr. Murray, the English lexicographer, cited by Jespersen as one of the means the language employs for the purpose of forming new words "by subtracting something from old ones," belong under the head of "reduction." In this way *darkle* is derived from *darkling; pup* from *puppy; cad* from *cadet* or *caddie; grovel* from *groveling; difficult* from *difficulty,* etc. It is evident that the "back-formation" variety of "reduction" may be of great service in the future development of our language, being another aid in the process of survival as a world-tongue. A very recent addition to the vocabulary of to-day is "to *typewrite,*" from *typewriter*—in England "to *type*" is much in vogue, a word which illustrates admirably the process in question.

THE OLD ACADEMY OF SCIENCE, PARIS. 1699–1793

II

By Dr. EDWARD F. WILLIAMS

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IN his account of the Old Academy of Science M. Maury expresses the opinion that the history of the development of science in connection with the Old Academy of Science should be read and studied as a chapter in the development of mind, a chapter as important and as interesting as any chapter in the political history of the century. It traces contests in the search for truth. Of hardly less importance in the history of literature is the work done by the two academies of Science and of Inscriptions than that done by the French Academy itself, devoted as that is to literature alone.

The Academy of Science was reorganized in the last year of the seventeenth century by Ponchartrain, minister of state, and put under the control of his nephew, the Abbé Bignon, a man well fitted for the position he was chosen to fill. The decree of reorganization was signed at Versailles on January 26, 1699, and read to the academy on February 4. A change was made in the number and character of the members. Henceforth there were to be four classes of members: active, or pensionary, who were to reside in Paris and give their time to the study of science; honorary members who might be either foreigners or natives of France; associate members; and pupils, young men of promise who were admitted to the academy as students and helpers of its active members with the expectation that some time they would be received into the academy. Under the new arrangement all branches of science were represented. Larger and better rooms than had been occupied, rooms in the Louvre which the King himself had occupied, were set apart for the use of the academy.

A public meeting in honor of the reorganization was held on June 2, 1699. Fontenelle had taken the place of Duhamel, who had held the position of secretary from the establishment of the academy by Colbert in 1666. Fontenelle's eulogies, read at each annual meeting for a third of a century, are a history of the academy in the lives and work of its members. They are famous alike in the annals of science and of literature. The academy had a president, a vice-president, a director, and a sub-secretary, as well as a perpetual secretary. The director and his assistant were selected from the active members of the academy, the

president and vice-president from the honorary members. They were to represent the king, who nominated them and approved or disapproved all elections. These high officials were all of noble blood.

In the reorganization of the academy the names of men who had failed to attend its meetings with regularity or to show any real interest in its work were dropped, but old men who were still active were retained in spite of their conservative tendencies. The academy at once put itself into communication with scientific societies in the provinces, and also with academies in other countries in which the problems of physics, astronomy, mathematics and chemistry were studied. Personal relations were established between the astronomer Cassini of Paris and astronomers in England, Holland and Italy. Much attention was given to experiment, and special efforts were made to widen the horizon of observation by travel. Expeditions were equipped and sent out to various parts of the world at the king's expense.

In spite of the conservatism of the academy and discussions which lasted half a century the opinions of Newton in physics were finally accepted and those of Descartes rejected. Discussions over the calculus lasted more than five years. The theories of Newton were received in Holland, at St. Petersburg, and in many parts of Germany before they were current in either England or France. In 1726 the academy crowned a work by Père Mazieres of the Oratory which proved beyond a doubt the existence of the vortices of Descartes! In 1730 Jean Bernouilli published a volume on the same side and in 1736 Cassini de Fleury sought to harmonize the theory of vortices with Kepler's Laws. Fontenelle joined in the effort and was supported by two learned societies in Paris. Le Beau, of the Academy of Inscriptions, spoke jestingly of Fontenelle and Camille Falconyet, as "two old men besieged in a fortress formed of the vortices of Descartes in which they were defending themselves against the attacks of impetuous youth." The final blow against Cartesianism was struck by Buffon in 1747, although the way for the acceptance of the teachings of Newton had been prepared by Cardinal de Polignac.

Notwithstanding the fact that the academy was organized and sustained for purposes of investigation and in order to increase knowledge, and the further fact that its members above all other men were expected to favor and defend new views, it is not unnatural that conservative opinions should prevail. Some who were in the academy cared little for science in the true meaning of the word. Some favored those branches of study in which they were personally interested and had little interest in what was done in other branches. The Church defended the old views. It was opposed to any opinions which might lead to a change in methods of teaching. In the middle of the century France was behind countries like England, Holland and Germany in its knowledge of astronomy, geometry, physics and medicine. True such men as

Clairaut and Réaumer were leaders in the academy from 1700 to 1750, but Clairaut can not be put by the side of Newton in mathematics, or even of Leibniz, nor, eminent as he was, had he the creative mind of Bernouilli. Yet he was not without honor in other countries as well as in his own. In 1750 his Lunar Tables were crowned by the Academy of St. Petersburg. Réaumer, a many-sided man, carried physics to the heights where Buffon and Cuvier found them. Yet during the first half of the century the academy was unable to point to many men of the first rank among its members. Nearly all of them were men of ability, eager in the pursuit of knowledge, but wanting in those peculiar gifts which belong to men like Newton, or Descartes, or Leibniz. Yet the academy did a vast deal of excellent work. Problems relating to the sun, the moon and the earth were carefully and patiently studied. Newton's theories were shown by D'Alembert to be true, Bradley's discovery of aberration of the stars was made more valuable by measuring that of the planets and of the sun, and by estimating the amount of attraction on the earth. Thury discussed the figure of the earth. Thus, as M. Maury says, "a sort of propylea was formed for the Mécanique celeste of La Place." If Clairaut lacked somewhat in intellectual domination on account of the gruffness of his manners and his love of solitude, in all these respects Réaumer was his opposite. At his reception into the academy he read a paper on gravity, but he devoted his life to the study of the problems of physics. Dissatisfied with the Florence thermometer then in general use, he invented one which met the needs of the time. He made important discoveries in zoology, and wrote a fine history of insects. In practical affairs he was useful in improving the methods employed in the manufacture of pottery, and to his suggestions the iron industry owes a great deal. It is not surprising that with his attractive manners, his genial disposition, he should rule the academy for a score of years, and that he and Clairaut should be universally regarded as its two greatest men, whose fame was eclipsed in later years only by D'Alembert and Buffon.

New sciences like embryology gradually appear, and the sphere of those already studied is largely widened. De Lagny, who died in 1733, made important contributions to geometry and trigonometry, Nicole to the calculus of infinite distances. Joseph Saurin, 24 years older than Nicole, a Cartesian in physics but a Newtonian in mathematics, was also eminent for his knowledge of geometry. Carré published the differential calculus of Marquis de l'Hôpital, and Varignon, Fontaine and Clairaut improved and rendered more valuable the discoveries of Leibniz and Newton. The differential calculus we owe, so it is asserted, to the two Bernouillis, Joseph and Jean. During the period from 1699 to 1750 the academy was an important aid to mechanics, and it made large contributions to the knowledge of astronomy and geometry. In the first quarter of the century Dominique Cassini by his published

writings, and especially by his theories of the satellites of Jupiter and Saturn and his determination of their periods, brought the academy no little honor. The discovery of periodic stars in Hydra in 1704, by Joseph Maraldi, a nephew of D'Cassini, made an epoch in the scientific world. Through the influence of the academy astronomers in different parts of Europe were induced to study phenomena which as yet few had observed and none had explained. Brodiger's proposed explanations of the parhelia and the halos of the moon were deemed worthy of study at Greenwich and many other observatories. Bouguer in the Cordilleras saw aureoles surrounding his own shadow. After protracted and unsatisfactory discussions the academy decided to send an expedition to the pole and to the equator to measure the length of the meridian and determine the exact figure of the earth. La Condamine, accompanied by Bouguer and Godin, a young astronomer, not yet known to science, were sent to Peru in 1735. Maupertuis, Clairaut, Camus and Lamonier went to Lapland. At the suggestion of the minister, Maurepas, the expenses of the expeditions were paid out of the royal treasury. These expeditions and the increased knowledge which they obtained added very much to the scientific reputation of France as well as to that of the academy.

Yet disputes in the academy continued. Men like Maupertuis felt that their knowledge and reputation gave them the privilege of directing others. But men like Bouguer and Condamine resented the proffered instruction even of savants so distinguished as Clairaut and Maupertuis. These disagreements did not, however, prevent the academy from continuing steadily at its work. The journeys to the pole and the equator had furnished data from which it was shown that the earth is a flattened spheroid, though a century later Svanberg, a Swede, discovered errors in the calculations by which it had been made too flat. Condamine had taken with him as helpers an engineer, a horologist, a designer, and Joseph de Jussieu, destined to become famous as a botanist. Condamine was not satisfied with doing that for which he had been sent, and at his own expense and with great risk explored the Amazon. On this expedition he lost his thumbs and his ears. In 1738 he made quinine known to the world. Although not receiving the honor at home which he deserved, he has been called the Alexander von Humboldt of his time.

In 1749 an expedition was sent out to determine the moon's parallax. Efforts had been put forth in this direction as early as 1714. Observations at Berlin and the Cape of Good Hope had not been satisfactory. To secure better results Lacaille went to the Cape, Lalande to Berlin, Brody to Greenwich, Zandetti to Bologna, Wargentin to Stockholm, while Cassini de Thury remained in Paris. It was suggested that the phenomena to be studied should be observed at the same time at these different points. This friendship of scientists was better for the world,

many said, than the peace of Aix-la-Chapelle. Through the observations thus made errors were corrected and an impulse given to the study of astronomy which accounts in great part for the progress it made during the last half of the century.

Prior to the middle of the century little progress had been made in many of the sciences which in the next century engaged the attention of its foremost men. Sauvier had distinguished seven laws of sound and interested a good many men in their study. But at the beginning of the century the subject of acoustics was little understood and progress in its development was slow. Considerable attention was given to the subject of electricity, but neither Buffon nor D'Alembert believed that the calculus could be employed in this branch of science as it had been in setting forth the principles of astronomy and optics. A generation later than Buffon it was found that the calculus was of inestimable value in the study of every branch of science. Increase in the knowledge of chemistry was due quite as much to the pharmacists as to its special representatives in the academy. The contributions of one of these pharmacists, Etienne Geoffroy, in his tables of "Chemical Affinities" were of great value. Yet he did not realize, as Newton had done, the importance of his discoveries. As long as the influence of Descartes continued dominant in the academy, progress was difficult. Cartesians were content to explain the reciprocal action of molecules by mechanical forces. Such men as Nicolas Lemery and Fontenelle could see nothing but originality and useless knowledge in the discoveries of Geoffroy. They were unwilling to accept Newton's theory of gravitation. It was a long time before the principles accepted in England, or in Germany under the leadership of Stahl, in chemistry, prevailed in France. Up to the year 1780 the science of mineralogy in France was in a state of torpor. At that time the science of crystallography, and of geology, was unknown. Some progress had been made in the study of botany. As early as 1746 Guellard tried to persuade the academy to give its attention to the study of flora and fauna. The establishment of the Royal Gardens, chiefly for the benefit of medical science, had rendered the study of botany possible and attractive. In 1700 Tournefort, who had been at the head of the gardens since 1683, published his very important "Institutio rei herbariæ." His classification was based on color rather than on structure or function. The relation between descriptive and vegetable physiology was then unknown and was made of no practical value till a century later. Yet Tournefort recognized the existence of genera if not of species. In 1727 the existence of sex in plants was discovered. Not long after Tournefort's death Linnæus visited France, where he was warmly received and urged to remain as a member of the academy. Though refusing to leave Sweden permanently, he interested members of the academy in his theories and methods of classification which were at once seen to be an immense improvement

on those in ordinary use. Yet his methods were soon supplanted by those of the Jussieus.

There was a widespread feeling that the studies of the academy ought to be made of practical value to the people at large. For this reason Duhamel du Monceau, though abstract and severe in his methods of study, sought to use his knowledge for the benefit of agriculture and other industries. He improved the cereals of France, improved, if he did not introduce, the cultivation of the potato, discovered and taught the use of fertilizers, made forestry a science and published a treatise upon it which became a classic. Absence in England prevented his appointment as director of the Royal Gardens. This position was given to du Fay. Before the century was ended Buffon had grasped and proclaimed the unity of all branches of science. There was a growing interest during the last half of the century in zoology. Réaumur gave a great deal of attention to measures for increasing the collections in the museums, and studied the nature and habits of insects so thoroughly that he began, though he did not live to complete it, a six-volume work entitled "Mémoires pour servir à l'histoire des insectes." Of this work Buffon and many others made constant use. Buffon confessed his indebtedness also to the "History of Birds" written by Brisson, a physician and member of the academy. As representing the knowledge of ornithology at the date of its publication, about 1750, this work may be profitably consulted even now. In this branch of knowledge France was behind Sweden, Germany and England. Du Fay and Maupertuis were interested in the study of animals, especially salamanders and scorpions, yet this study was regarded by them only as a byplay. There was at the middle of the century only a single conchologist in France, Dezallier d'Argenville, and he was not in the academy. His book is still consulted. Laurent Jablot is said to have been the first man to study polyps and infusoria. As early as 1718 he anticipated not a few of the discoveries published to the world in 1740 by de Trembly of Geneva. Prior to the time of Réaumur polyps had been classed with vegetables. Anatomy and physiology were studied chiefly with reference to the science of healing. In the previous century men had been interested in these branches of study, some of them for their own sake independent of their relation to medicine. At the beginning of the eighteenth century Jean Méry, Joseph Guichard and Alexis Littré represented these subjects in the academy. Méry entered the academy about the time that Harvey made his discovery of the circulation of the blood, a theory the academy was slow to accept. Méry believed that in the embryo the blood circulates through the lungs. This theory was denied by J. G. Duverney, who gave special attention to the study of the glands and their relation to the urine and the brain. His papers were the subject of long and earnest debate. The problem

of generation was also a subject of discussion. There were two parties in the academy, the ovists and the spermatists, and the differences between them were not removed for a century and a half, or till it was discovered that fertilization is through contact. François du Petit, one of the physicians in the academy, devoted himself to the study of the brain and the eye. He was an anatomist from the cradle. It was a common saying that he listened to the lectures of Littré when he was only seven years old, and was able to prepare bodies for dissection at the age of nine. He was a man of vast knowledge and acquired great fame. Antoine Ferrein entered the academy in 1741. He advocated the theory that the circulation of blood is controlled by the heart. Winslow, a pupil of Duverney and unsurpassed as an anatomist save by Albinus of Leiden fifteen years his junior, confined his attention to the outside of the body, to monstrosities and to the dangers arising from certain kinds of dress. Discussions and differences in the academy increased and grew warmer with every addition to scientific knowledge, for the ability to harmonize the discoveries which were made nearly every year with what was already known seemed to be entirely lacking. Men had not yet learned how to compare one science with another. The study of comparative anatomy was in its infancy. Of paleontology almost nothing was known. This science did not receive attention in France till after 1725 when A. de Jussieu read his paper in the academy on the imprints of fauna and flora on certain rocks. These imprints he refused to consider and treat as whims of nature. De Maillet did not dare at this time to have his book on geology printed in France. It was not till Buffon's "Essay on the Epochs of Nature" appeared that men were willing to study nature from what was then called the modern point of view. Prior to 1740 the teachings of the church as to the origin of the earth were everywhere accepted. The entrance of philosophy into the academy added interest to its discussions. There were sharp differences of opinion as to what were living and what were dead forces. Leibniz had affirmed, Voltaire had denied, that the measure of force is as its mass multiplied by the square of its velocity. In this discussion Voltaire and Maupertuis took part. Every change in motion, said the latter, is brought about by the employment of the least possible amount of active force. The theory was attacked in the Berlin Academy by Samuel Koenig, with whom Maupertuis quarreled, and, although he was sustained in his contentions by the academy, it is now generally admitted that Koenig was justified in his criticisms. From the results of this quarrel Maupertuis never recovered.

As the discussions in the academy increased in intensity, and apparently in importance, public interest in its opinions increased also. In science its decisions were received as authoritative. Prior to the revolution not much attention was given to scientific studies in the schools,

but inasmuch as the members of the academy had received the best education, both in science and in philosophy, which France could furnish, it was entirely natural that the common people should accept their opinions without hesitation. The members of the academy lived simply, gave their time to their favorite pursuits, and through their publications had large influence on the civilization of France and even of Europe. The work of the academy through the century was directed by a few able men. Fontenelle, who succeeded Duhamel, the first secretary, felt the burdens of his position as early as 1730 and offered his resignation, which was not accepted till 1740. He was at that time eighty years old and his successor, Mairan, eminent for his attainments, was nearly as old. He was soon followed by Grandjean de Fouchy who had won fame as an astronomer, who retained his secretaryship for thirty years. Condorcet was his assistant, but the real control of the academy was in the hands of Buffon. Yet Buffon was unable to prevent Condorcet from succeeding de Fouchy.

At the death of Buffon there were other naturalists who were well prepared to take up his work and carry it forward even more successfully than he. They were less prejudiced than he against new opinions. Some of them could give more accurate descriptions of natural objects. Buffon's knowledge of science prior to the century and in a good degree up to his own time was extensive. It was not accurate like that of the Jussieus and of Lavoisier. He did little for the future save through his suggestions and his wide generalizations. He derived living beings from molecules, and the atoms in which Epicurus believed. But he did not solve the problem of generation. As an administrator he had few equals. His gift for order and arrangement was very great. He made the Garden of Plants a great help for students of science. Yet in most departments of science, England during Buffon's life was fifty years in advance of France. Yet the academicians were by no means idle, nor did they fail to appreciate the discoveries of their contemporaries in other countries. Men like Daubenton gave lectures in connection with the Royal Gardens and were on the lookout for young men to take the place of their elders in the academy. In his investigations he just missed having a share in making comparative anatomy a real science. Vicq d'Azyr, of Normandy, a pupil of Antoine Petit, carried the study of zoological anatomy to a great height. Buffon would gladly have seen him director of the Royal Gardens, but Daubenton took care to place him where his gifts as an anatomist would have full exercise. He was a member of the academy in 1774. His reputation rests on his work on anatomy and physiology published in 1786. Two years later, at the death of Buffon, he became his successor. He was the precursor of Cuvier. He was one of the first to point out the importance of the teeth in the study of animals.

The conservatism of the academy is shown in various ways, but

perhaps in nothing more clearly than in its willingness to reject inoculation as a protection against the ravages of the smallpox. In 1764 it was on the point of condemning it altogether, but was prevented from doing so by Petit, who was more reasonable than some of his associates. A few years later Jenner was made an associate member of the academy. Bailly's report, which appears in the *Mémoires* for 1784, carried the day for inoculation. Inoculation was favored by at least two of the king's ministers, Turgot and Malesherbes. About this time Mesmer was in Paris and by his lectures and experiments created much excitement. The academy appointed a committee of which Dr. Franklin, then a resident of Paris as a representative of the United States, was a member, to visit Mesmer, but Mesmer refused to impart his secrets to him or to any one outside his chosen circle. Although de Jussieu was favorably inclined toward Mesmer and his methods, Lavoissier, Bailly and Franklin reported against him. In spite of the opposition of the academy, Mesmer prospered, though his theories were not widely propagated during the Revolution. Subsequently mesmerism was opposed as a species of somnambulism. The academy was called upon to find a remedy against the bite of mad dogs but was unable to do so. The sufferings of the people during the later years of Louis XVI. drew the attention of the academy away from the study of science to the consideration of means for helping the people. The price of bread had risen to such a height that the academy was asked to consider its cause and to see what could be done to bring it back to the former figures. A wise report, showing that the price depended always upon the price of cereals, made by Leroy, Desmourets, and Tillet did something to calm public feeling. In 1782 the aid of the academy was asked by the States Assembly to help in determining the proper values of land. Through the impulse given by the Montyon prizes, offered as early as 1779, some successful efforts were made to protect the lives of men whose work exposed them to unhealthy conditions. In 1784–5 a work on metals by Henri Albert Josse, of Geneva, received the approval of the academy.

The academy, though careful not to express itself on any political question, did not escape suspicion during the terrible days of the Revolution. Some of its members, Bailly and Lavoisier, perished on the scaffold. Condorcet committed suicide. The lives of others, Malherbes, Bochardt and Saron were undoubtedly shortened by the strain of the period. Yet the new government strove for a time to make use of the knowledge of its members. They were asked to draw up and present to the Assembly a system of weights and measures, as well as of money, which would meet the demands of the new era. The first committee was composed of men like Lavoisier, Lagrange, Borda, Condorcet and Tillet. The request was repeated in 1792 and was referred to a committee composed of Lagrange, Berthollet, and Antoine Manges, of the Academy of Inscriptions. This committee reported in favor of

the decimal system which was afterwards adopted. Meanwhile the work of the academy was supposed to go on without interruption. But its sessions could not be held regularly. Some feared to attend them. Bailly and Condorcet did not venture to show themselves at these meetings. Yet Lagrange, Laplace, de Jussieu, Desfontaines, Adamson, Haüy, Berthollet, Coulomb, Borda, Bossuet, Portal, Thomasin, Daubenton and Lavoisier were usually in their places at every session of the academy. Lalande acted as secretary. November 14, 1792, Chanfort moved that the sessions of the academy be suspended. This motion did not carry, though a similar motion passed November 26. The last meeting, however, was held December 21, at which it was voted to adjourn for Christmas. Although the academy did not meet as an academy, the ministers of the government continued to ask its advice as late as January, 1793. A Commission of Public Instruction sought its opinion as to a system of weights and measures. The opinion was given by Borda, Laplace, and Lagrange. The report which these men made is the last report which appears on the records of the Old Academy. Yet many of its members wrought as patriots for their country. Fourcroy discovered a new method for making saltpeter, Guylonde, Morceau and Berthollet worked on steel, Monge gave his attention to improving the foundries, and A. C. Perrier to forges. August 6, 1793, the Convention sent to the academy, which it suppressed August 8, a request for its opinion as to the value of money. August 14, 1793, Lakenal, as one of the officers of the new government, issued a decree requiring the members of the academy to meet in their old place and be ready to answer any question which might be sent them. But these meetings were irregular and of little value. The academy had been proscribed as the enemy of the Republic. During the four years from 1789 to 1793 half of the members of the Old Academy died. Many of them had lived in poverty, all of them in fear. October 25, 1793, the Convention ordered the establishment of the *Institut,* of which the Academy of Science might form one of its classes. It was indeed its first class. It was intended to serve the Republic by its practical knowledge of mathematics and physics. Nothing was done at this time toward establishing an Academy of Moral and Political Science, or of Literature and the Fine Arts. These were to come later. This order, which was secured through the influence of Lakenal, was, as a matter of fact, carrying out the order of the king as issued April 23, 1783. All science was united in two great classes, physical and mathematical. By the Republic these classes were made sections of the *Institut.* In each of these sections there were three *pensionaires,* and three associates. In 1803 another reorganization took place and in the new *Institut,* the Academy of Science was given the third place. Its further history is the history of a section of the French Institute.

HISTORY OF GOLD MINING IN THE UNITED STATES

By Professor R. A. F. PENROSE, Jr.

PHILADELPHIA, PA.

Period from 1800–1848

GOLD was known by the Indians to exist in the United States long before the white people discovered it, but unlike the Indians of Mexico, the more northern natives did not make elaborate use of it, and it did not seriously attract the attention of the settlers until shortly before the beginning of the nineteenth century. No very important mining, however, was done until after 1800, when a little gold began to be obtained in North Carolina. Long before that time the gold of California had also been known to the natives and to the Franciscan monks, but that country then belonged to Mexico and was not taken by the United States until 1846.

The first important gold mining, therefore, in the United States was in North Carolina, when shortly after 1800 the auriferous gravels of Cabarrus and Montgomery counties were worked in a small way. From that time until 1827 small quantities of gold were produced in these and other parts of North Carolina, though not enough to cause much excitement; but the discoveries then spread into the adjoining states, and in the next two or three years South Carolina, Georgia and Virginia began to produce important quantities of gold, while Alabama and Tennessee also soon began to supply a small amount. In the meantime gold-bearing veins had been discovered in addition to the gravels, and from the two sources the production of gold grew considerably. A great excitement followed and many thousands of people rushed to the gold diggings.

Later discoveries extended the area in which gold was found until it had been traced from Alabama northeastward to the Canadian border, but very little was discovered beyond Virginia. The gold deposits characterize certain geologic horizons which flank the east slope of the Appalachian Mountains, and the most productive part of this belt has so far proved to be in western North Carolina, the adjoining part of South Carolina and northern Georgia, while Virginia and Alabama have been smaller producers and Tennessee has supplied a little. In the states north of Virginia small quantities of gold have occasionally been found, but not enough to be of much commercial importance,[1]

[1] Exception to this must be made where small quantities of gold are produced as a by-product from copper ores in Tennessee, Maryland and New Hampshire, and from iron ores at Lebanon, Pennsylvania.

while to the south, the gold formation, after passing through part of Alabama, disappears under the younger formations of the lower Mississippi Valley.

The annual production in the southern states never reached much over $1,000,000, and up to 1847 the total had been $24,537,000.[2] After that time the production fell off considerably, and though it rose later under the general stimulus to gold mining caused by the California discoveries, it soon fell again. Mining still continues, however, to the present day, and the production some years reaches several hundred thousand dollars, in others only a small part of this amount. The experience people had obtained in gold mining in the south and the fact that the production of that region was on the wane, caused them to be quickly attracted to new fields when the reports of the discoveries in California reached the east in 1848.

Period from 1848–1859

The gold of California was known long before 1848, but the knowledge concerning it was too vague to attract much attention. About 1769, when California was a remote Mexican province, the Franciscan monks began to establish missions along the coast for the conversion of the Indians, and gradually extended their influence over them, employing many in rural pursuits and trading with the others. The missions became the seats of government of prosperous communities, and the Indians from the outside, who came to trade for provisions and clothes, were observed to be always well provided with gold dust for this purpose. The monks thus became aware that an abundance of gold existed on the west slope of the Sierra Nevada, but they feared the effect such news would cause if it reached the outside world. They remembered the cruelties that had been practised by the early explorers of Mexico and South America in their mad rush for gold, how the land had been devastated, towns destroyed and whole tribes almost annihilated by the plunderers. They knew that there would be a rush to California if its wealth became known, and they feared that the man of their own day would be no more conscientious in his methods of securing gold than had been the man of the sixteenth century. They saw the possibility of their quiet settlements being disturbed and their power overthrown; hence they concealed their secret. In the meantime a little mining had been done from time to time by adventurous strangers who came that way, but the results were not sufficiently important to attract much attention, and the gold of California did not become generally known until it was discovered by Americans in their irresistible trend westward.

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[2] Report of the Director of the Mint, 1910.

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[2] Report of the Director of the Mint, 1910.

January, 1848. Americans had begun coming into California several years previously and a colony was already established near where Sacramento now stands. Marshall was constructing a saw mill some forty miles distant on the west slope of the Sierra Nevada and on the south fork of the American River, which is a tributary of the Sacramento River. He observed some glistening particles in the gravel washed by the waters of the mill, and at once identified them as gold. A few days later he went down to the settlement on the Sacramento River to tell of his discovery to Colonel Sutter, with whom he was associated in the erection of the mill.

In spite of all efforts to keep the discovery from public notice the news spread; the people in the neighborhood made further search, and soon found gold to be abundant in many other places. The excitement rapidly increased, and by the summer of 1848 several thousand people were already mining in the neighborhood. San Francisco, then a small village, was almost depopulated in the sudden exodus for the gold fields. By autumn the news had reached the eastern states and foreign countries, and history has never before or since recorded such a mad rush of different races of people to a common center, overcoming difficulties that would have been considered almost insurmountable had it not been for the idea of gold, limitless gold, lying there in the ground to be dug up by the first who came. Among the earliest to arrive from the outside were Mexicans, Peruvians, Chileans and Chinese, as they could reach the region quickly by sea; but the great tide of immigration that soon came from the eastern states, around Cape Horn, across the Isthmus of Panama and over the emigrant trail, soon placed the Americans in the majority, and by the end of 1849, there were nearly 100,000 miners on the ground. Thousands of others died on the way, from exposure and starvation, from heat and thirst in the desert, from attacks by the Indians and from cholera, which killed many along the trail in 1849.

In the meantime one discovery of gold rapidly followed another in the gravels of the many rivers and creeks that run down the west slope of the Sierra Nevada, and miners were soon working for over 150 miles along the mountains. Since then the range of the gold discoveries has spread over wider limits, reaching from the northern to the southern boundary of the state, but the larger part has come from the region worked in the early days, extending from Mariposa County on the south to the Feather River on the north. Fortunes were made quickly and lost with equal facility, but in the meantime a new region was being developed with wonderful rapidity and the western progress of the United States had, as if by a single jump, been advanced over fifteen hundred miles, from the Missouri River to the Pacific Ocean. Throughout the world, the discoveries in California stimulated interest

in gold mining, and as a direct result the great Australian gold fields became known in 1851 and mining in the gold regions of the southern states was greatly stimulated. With all these notable results, it is pathetic to relate that Marshall, who discovered the California gold, and his associate Sutter, both died poor and disappointed men, many years later.

The first gold mining in California was done along the bars and banks of rivers and creeks, while later the whole streams were turned from their courses, and the gravel in their beds was washed for gold. The American, Yuba, Feather, Stanislaus, Tuolumne and other rivers, became famous as gold producers. The gravels in the dry ravines were also washed, and these were called "dry diggings" in distinction from the river, or "wet diggings." When the gravels in the lowlands began to show signs of exhaustion, the miners sought others higher up in the mountains, and there they found the old Tertiary deposits, known as "high gravels." In the meantime the gold-bearing quartz veins were discovered, and thus began the operation of many of the more lasting mining districts of California, such as Angels Camp, Chinese Camp, Amador City, Sonora, Grass Valley, Nevada City and many other places which made the great Mother Lode and other quartz lodes of the Pacific Coast famous.

In the early mining operations, gold had been obtained by digging the gravel by hand and washing in pans or in the devices known as cradles and sluices; but when the richer deposits were exhausted and lower grade gravels had to be worked, efforts were made to find means to mine on a larger and cheaper scale. The result was the introduction of what became known as hydraulic mining, a process invented in 1852 by Mr. Matteson, from Connecticut. This consisted in throwing a stream of water through an iron nozzle, called a monitor, under immense pressure, against a gravel bank. The gravel was thus torn down and washed through the sluices, where the gold was recovered. The method was so much more rapid than the old devices, that it was extensively introduced, and whole hills were washed away. In the meantime, however, the farming interests of California had become important, and the immense quantities of gravel and sand washed into the rivers by hydraulic mining filled the channels and caused floods, which devastated the lands. This difficulty became so serious that in later years a law was passed restricting hydraulic mining in places where the débris interfered with farming lands below. Still more recently the process of working gold-bearing gravels by dredging has been extensively introduced and has considerably increased the production.

The most productive era in California gold mining was from 1850 to 1859, when the average annual output was about $55,000,000, while

the year of greatest output was 1853, when almost $65,000,000[3] were produced. After 1859 the production fell off greatly, partly from the exhaustion of the richer placers, and partly because thousands of California miners left for the Comstock lode. In 1889 it had fallen to a little over $11,000,000,[4] but in more recent years it has risen again, and has ranged from about $16,000,000 to over $21,000,000 annually. The total production of gold in California from 1848 to 1910 has been over $1,500,000,000, or almost half of the total production of the United States to date.

Period from 1859–1890

While these events were going on in California, gold and silver were being discovered in many places in the Rocky Mountains and in the desert country between them and the Sierra Nevada, known as the Great Basin. Though these regions are nearer the eastern states than California, their mining resources were not developed until long after those of the latter. This was due to several causes: The mines of California had already been discovered while those of the interior were as yet unknown; many California pioneers came by sea and knew nothing of the interior, while those who came by the emigrant trail found the difficulties and dangers such that they felt fortunate when they crossed the Sierra Nevada and entered the fertile valleys and salubrious climate of the coast. They tarried, therefore, as little as possible in the Rocky Mountains and the Great Basin, but hurried on to where they knew gold existed and where they would be safe from dangers which had already lined the emigrant trail with the bones of thousands of people. Hence it was not until over ten years after the discovery of gold in California that important mining began to the eastward.

After the California placers had been shorn of their richest treasures, many men left them to seek new discoveries, spreading north and south along the coast, and eastward beyond the Sierra Nevada. The result was that many mines which have since become noted were found during that time. Among them the most celebrated was the Comstock lode, which was destined to produce more gold and silver than any other one lode that history had recorded, and the development of which was accompanied by the most sensational and dramatic series of events ever recorded in a mining camp.

The Comstock lode is situated on the slope of Mt. Davidson, just east of the main range of the Sierra Nevada, some twenty miles beyond the California border, in what is now Nevada, but what was then a part

[3] Report of the Director of the Mint, 1910.

[4] Charles G. Yale, California State Mining Bureau, Report State Mineralogist, 1896, p. 64.

of the Territory of Utah. It is just south of the emigrant trail over which many early explorers of California had passed, but the region was a dry, inhospitable desert, destitute of vegetation and inhabited only by a few half-starved Indians, so that the pioneers had given it but little attention. Shortly before the discovery of the Comstock, however, some placer gold was found in that vicinity and a small settlement started, which later became Carson City. In 1857 two brothers named Grosh discovered the Comstock lode itself, but they died shortly afterwards, and the next year it was worked in a small way by others. Large bodies of ore, however, were first found in 1859, and then the news of the discovery spread rapidly and a great rush of people commenced, among them Henry Comstock, for whom the lode was named. The town of Virginia City sprang up from the desert and became a flourishing community.

The Comstock lode is an immense vein about four miles in length and several hundred feet in width, enclosed in igneous rock. Its great size admitted the locating of numerous mines along its course, many of which later became famous, such as the Consolidated California and Virginia, the Yellow Jacket, Crown Point, Hale and Norcross, Ophir, Belcher, Chollar and many others. Virginia City was at that time more accessible from San Francisco than from any other city, and hence the latter place became the supply point for the wants of the Comstock mines. San Francisco capital and energy poured into the district; the Comstock mining stocks were listed and dealt in on the San Francisco exchange, and San Francisco grew rich with the Comstock's millions. The gold discoveries in California had given San Francisco its first boom and had raised it from an obscure village to an active, bustling seaport; the discovery of the Comstock advanced it still further to a great city and one of the most important seaports in the world.

Mining progressed at a rapid rate at Virginia City, the mines reached great depths, and the water and heat increased at an abnormally rapid rate. It was then that Adolph Sutro commenced the great tunnel which bears his name, with the object of draining the mines and making an easier outlet for the ore, but before the project was completed the great "bonanzas" were largely exhausted, and by 1880 the production of the district had greatly declined. For a long time after that, mining consisted mostly in going over the old workings and waste dumps where the haste of the early days had left many rich pickings, but in recent years some entirely new development work has been started, and some of the old mines have taken a new lease of life.

The ore of the Comstock lode carried both gold and silver, with silver in the preponderance. In the haste and excitement of early days, accurate records of production were often neglected, but the total output of the Comstock mines to date has probabaly been between $400,-

000,000 and $500,000,000, while some estimates are even higher. So great was the quantity of silver produced that the monetary ratio between gold and silver was disturbed, and the curtailment of the coinage of silver in several countries of America and Europe was brought on partly by the immense quantity of the metal suddenly thrown on the world from the Comstock mines.

In the meantime the Rocky Mountains had been receiving the long-delayed attention of the prospector, and in 1858 gold was found in Colorado, in the sands of Cherry Creek, a tributary of the South Platte River, where the present city of Denver soon grew up. Pioneers poured in from the east, and discoveries followed in rapid succession. In the following few years the mines of the Blackhawk, Central City, Golden, Breckenridge, Boulder and other districts were discovered. In 1859 the placer gold of California Gulch, near where Leadville now stands, was discovered, and the town of Oro City sprang up. The diggings were soon exhausted, however, and Oro City vanished, to be replaced a few years later by Leadville, which grew up after valuable silver ores were discovered in the same locality. Many of the early gold districts of Colorado continue to produce gold, and though some of them are not so much heard of now as are the later discoveries like Cripple Creek, yet they have added largely to the prosperity of the state.

In the meantime the report of the discovery of gold on Pikes Peak drew a vast multitude of people there in 1859, only to be disappointed in their search. Their numbers were greatly increased by many of those who suffered in the financial panic of 1857, and about 100,000 people are said to have sought the new region in the first year. Nothing of value was found on Pikes Peak, and many of the enthusiastic explorers, who had traveled thither in the wagons known as prairie schooners, bearing the inscription "Pikes Peak or Bust," went away with this changed to "Busted." Little did they dream in their disappointment that just west of Pikes Peak, on the small stream of Cripple Creek, were immensely rich gold deposits, that were to be discovered thirty-odd years later. Though the Pikes Peak episode was a failure, it had the effect of bringing a large number of people to Colorado, many of whom, instead of going home, started into the mountains and were the early explorers of mining camps throughout the west. The high and rugged character of the Rocky Mountains in Colorado impeded, though it could not altogether stop, the direct passage westward; in fact, so dangerous were some of the mountain trails that the expression that a man had "gone over the range" came to be applied to any one who had died, and is still heard among "old timers" in many parts of the Colorado Rockies. Hence the Colorado miner tended to spread to the south and north, while the Californians continued to spread along the Pacific coast and eastward into the desert. The two tides of exploration

rapidly invaded the interior country, and between 1860 and 1885 made many discoveries, the mining camps to the eastward becoming affiliated with Denver as a center, those to the westward having closer relations with San Francisco. Even to-day this distinction is observable.

After the discovery of the Comstock lode, Californians began to appreciate the possibilities of the desert and they rapidly overran that region, but even before the discovery of the Comstock they had begun to explore the region east of the Colorado River, then known as New Mexico, but later divided into New Mexico and Arizona. Here gold had been mined by the Mexicans long before the American conquest, and many of the old mines were reopened and new ones discovered by the American miners. As early as 1853, the old town of Tucson became an active mining center, and somewhat later the gold mines near Prescott, Phoenix, Santa Fé and many other places were developed. Between 1860 and 1864 the gold of the region now included in Idaho and Montana was discovered, and the Snake, Clearwater and Salmon River regions, the Boisé Basin, the Owyhee region, Deer Lodge, Bannack City, Alder Gulch, Helena and many other districts became important gold producers.

Though all these discoveries were of much local importance, no one of them was great enough to mark an epoch in the gold mining industry of the country, as was the case in the discovery of the gold of California and the Comstock. An exception to this, however, should be made in the case of the Boisé Basin and the surrounding country, from which many millions in gold were taken in a short time. Most of this gold, however, was sent to San Francisco, and in those early days, when people were too busy to keep very accurate records, a large part of it was credited to California mines; but those who know the Boisé region and the prosperous city of Boisé are familiar with the immense production that once came from there.

We now come to the discovery of gold in the Black Hills of South Dakota, a region somewhat removed from those we have been discussing. In 1874 General G. A. Custer, while on an exploring expedition there, reported gold in some of the stream beds. The following year miners began to come into the region and very soon a general rush for the new gold fields occurred. The Black Hills, however, were then a part of the Sioux Indian reservation, which was not open to settlers, and the various United States military posts were instructed to keep the people out; but in spite of this and the fierce opposition of the Indians, numerous exploring parties managed to reach there; and finally, in 1876, this mountainous region, which had long been looked on by the Indians as their last resort for safety, was thrown open to settlers. From that time until the present the Black Hills region has been a steady producer of much gold and some silver, the production of gold usually

amounting to several million dollars yearly, and aggregating, up to 1910, approximately $150,000,000. At the present time, the old placers have been largely exhausted, but the gold-bearing veins are extensively worked, especially at the celebrated Homestake Mine.

Effect of Discoveries of Silver on Gold Mining, 1859–1890

While the gold of the west was thus being found and poured into the mints and commerce of the world, numerous discoveries of silver ores, often of immense value, were being made in the Rocky Mountains and the Great Basin. The first great discovery of silver ore in the United States was that at the Comstock lode, but others followed rapidly, until the multitude of mines opened between 1860 and 1885, made the United States the greatest silver producer in the world. Silver was then valuable, the deposits were larger than had ever been known to exist before, and the profits were immense. Towns grew up based entirely on the silver industry, and silver was the chief topic of the thoughts, conversation and daily pursuit of the people; the prospector looked only for silver, and a class of people began to grow up who knew silver ores but not much about other ores, so that many gold deposits were passed over, to be discovered years later.

This condition of affairs had the effect of stimulating the silver industry to its greatest extent, almost to the total exclusion of the search for gold, and discovery after discovery of silver deposits in the Rocky Mountains and the Great Basin was the result. First came the Comstock lode in 1859, and then followed rapidly between the years 1860 and 1885 the Reese River, Eureka, White Pine, Pioche and the Calico districts in Nevada; the Park City, Little Cottonwood Cañon, Frisco and Tintic districts in Utah; the Leadville, Silver Cliff, Aspen, San Juan districts in Colorado; Butte City, Montana; Tombstone, Arizona; Silver City and Lake Valley, New Mexico; Coeur d'Alene, Idaho, and in more recent years, Creede and Tonopah. Many other regions of silver discoveries might be mentioned, but the above list shows the vastness that the industry had reached.

Effect of Depreciation of Silver on Gold Mining, 1875–1890

The enormous production of silver, accompanied by increasing outputs in Mexico and elsewhere, brought about the inevitable result and caused the fall in the value of the metal. At the time of the opening of the Comstock lode in 1859, the price of silver was $1.36 per ounce. Until then silver had been very scarce, and in spite of the enormous output of the Comstock and other mines discovered later, the price of the metal held up wonderfully until 1873, ranging in value from $1.36 to $1.29. The great flood of silver that was being produced, however, finally made itself felt, and slowly but surely the price fell. In the

meantime the governments of America and Europe, fearing that silver was becoming too common a metal, began to curtail its coinage; and this action still further depreciated its value.

Previous to this great output of silver the enormous quantity of gold from California and Australia had discredited the stability of the value of the latter metal, and silver was considered by many to be the safer of the two for coinage. In fact, Holland had actually adopted a silver standard for coinage in order to avoid the dangers of the depreciation of gold, but from the day the output of the western mines made people realize the possibility of an enormous production of silver, that metal fell into disrepute. In 1886 the price fell for the first time to less than $1 per ounce, and after that it continued downward, with occasionally slight fluctuations upward, until it went below 50 cents per ounce. In late years, with the curtailment of production, silver has risen somewhat and has ranged a few cents above fifty cents an ounce. At the present time most of the great mines that were once worked entirely or mostly for silver are closed, and the production of that metal in the United States, though still large, is derived principally from ores containing both gold and silver, and as a by-product from copper and lead ores, with a little from zinc ores.

With the closing of the silver mines many men were thrown out of employment, and thousands of them started into the mountains to find something more desirable to work than the discredited silver. The long-neglected search for gold attracted many of them, for in gold they saw a metal that was not falling in value day by day. The result was remarkable, and in an incredibly short time many new discoveries of gold began to be made.

Period from 1890–1911

The Cripple Creek district in Colorado was the most noted of the early gold discoveries following in the wake of the fall of silver, but so little confidence was put in it at first that those working there were scoffed at and called "alfalfa" miners by the old-time silver men; yet in a few years it was producing many millions annually and Colorado had risen to the foremost ranks as a gold producer. The gold of Cripple Creek was discovered in 1890 by Robert Womack, but was first actively worked in 1891 by E. C. Frisbee and E. M. De La Vergne; and in 1892 and 1893 the rush began which brought many thousands to this new El Dorado, where they hoped to recuperate fortunes lost in silver mining and in the financial panics of that time. The town of Cripple Creek suddenly sprang into existence high up on the mountains just west of Pikes Peak, and soon had a population of over 10,000 people, while the surrounding district contained several times that number. Many millions were produced yearly, and though the output is now less than

formerly, it is still large, and Cripple Creek possesses a record for gold production rarely equalled. The total production up to 1910 was over $200,000,000.

The gold of Cripple Creek occurs mostly in veins, though some small placer deposits were worked in the early days. Instead of one great vein as at the Comstock lode in Nevada, there are very many smaller veins, representing ore bodies formed in fissures in the choked-up neck of an old volcano. Erosion has altered the appearance of the volcanic vent, but the geological structure proves the origin of the region.

About the time of the discovery of the Cripple Creek district, new gold deposits were found at Leadville, in Colorado. We have seen that gold placers were worked in this region in 1859, but were soon exhausted, and that in 1874 silver-lead ores were discovered and again brought a boom to the region. With the fall of silver, Leadville had lost much of its prosperity, but again picked up on the discovery of gold ores shortly after 1890. About this time, and later, many mines in the San Juan region and elsewhere in southern Colorado also became important gold producers.

Following quickly in the train of the fall of silver, news came of the discoveries of gold in the Klondike region. The Treadwell and other mines in southern Alaska had long been worked, but in the far north mining had not been very active. More or less gold had been mined on the Yukon and its tributaries for many years, and from 1886 to 1895 interest was somewhat stimulated by discoveries on Forty-Mile Creek, Koyukuk River, Mission Creek, Mynook Creek, Tanana River and many other streams flowing into the Yukon; but the production was not very great and the industry was carried on in a desultory way. With the discovery, however, of gold on the Klondike River in 1896, this apparent apathy was turned to the wildest excitement.

The Klondike River is in the Yukon Territory of Canada and flows into the upper Yukon River east of the Alaska border. Gold was discovered there on August 17, 1896, and a stampede to the new district followed which will always be memorable for the hardships encountered and the frightful mortality among those who took part in it. By 1898 over 40,000 people were camped on the Yukon, at the mouth of the Klondike, while many had died on the way, frozen on the White Pass, or on the long winter trail from Edmonton, or starved in the forest, or drowned in the Yukon, or shipwrecked in the Pacific. Whole parties often perished and nothing was heard of them until perhaps years later their outfits were found on the wilderness trails. Dawson City came suddenly into existence on what a few months before had been a barren river bank, and took its place as the metropolis of the gold regions of Arctic America. Soon after the first discovery of the Klondike gold, the deposits on various smaller streams in the vicinity, such as Bonanza

Creek, Eldorado, Hunker, Gold Bottom, Dominion, Sulphur, Gold Run, Quartz and other creeks, were found.

The richest of the Klondike placers were exhausted in a few years, the production began to fall and people predicted the end of mining there, especially as no very important gold-bearing veins had as yet been discovered; but in recent years, with the introduction of more modern and economical appliances, the immense areas of low-grade gravels are being successfully worked, and the Klondike will probably be an active gold producer for many years to come.

In 1898, at the height of the Klondike excitement, gold was found at Cape Nome on the Alaska Coast of Behring Sea, north of the mouth of the Yukon. The first discoveries were made on Anvil Creek, a few miles back from the beach, and during the following year in the beach sands themselves. Again a stampede started to the north, and though not so many people went there as to Dawson City, yet the number was considerable, and large quantities of gold were quickly produced by those who were fortunate enough to escape shipwreck and other disasters on the way.

The result of these far-north gold discoveries was the exploration of that country many years before it would otherwise have taken place, and in a very short time the region, up until then little known, except in spots, became familiar to all. The whole of it has since been overrun by the prospector, and many other gold districts than those mentioned have been found, but the chief producers to-day are the Klondike, Cape Nome and the Fairbanks regions, the last being on the Tanana River, a tributary of the Yukon in Alaska. The production of Alaska in 1910 was estimated at $16,987,990, while that of the Yukon territory of Canada, which includes the Klondike, was estimated at $4,550,000, a decrease from the maximum of $22,275,000 in the boom year of 1900.[5]

The Goldfield district in Esmeralda County, Nevada, was another discovery that followed after the fall in price of silver, and here from 1902 to 1904, and later, were found great deposits of gold-bearing quartz that have made the region one of the most important gold districts of the world. The Goldfield Consolidated Company to-day is the largest single gold-producer in the United States, its output in the year ending October 31, 1910, being $10,866,752. The region is not far from the Comstock lode, and many an old prospector of the latter region doubtless trod over it without realizing the value of what was to be discovered over forty years later. Other districts in Nevada, such as Silver Peak, Rawhide, Bullfrog, Round Mountain, Delamar and many other places, also became important gold-mining centers; and Nevada,

[5] "Mineral Industry," New York, 1910, p. 266.

like Colorado, from being mostly a silver-mining state, has become a great gold producer.

In the same way, after the fall in silver, the mines of Fergus, Chouteau, Madison and other counties in Montana, assumed fresh activities; in Idaho the old gold regions of the Boisé Basin and other places in Boisé County, as well as in Owyhee and other counties, again attracted attention; in Utah the old gold mines at Mercur, in the Camp Floyd district and elsewhere were reopened; in Arizona some of the gold districts of early days, which had long been abandoned for silver mining, were reopened, while new discoveries were made in many places, especially from the Gila River northwestward to the Colorado River; in New Mexico several old districts were reopened and a few new ones discovered. In California there was a general revival of gold mining and the production materially increased. New discoveries were made in the northern part of the state, in Shasta, Trinity and other countries, and also in the barren regions of the southern part, where many districts were added to the list of producers. Oregon and Washington also felt the stimulus to gold mining, though the production from those states has never been large. Even the Philippine Islands have begun to produce some gold, and though the amount is yet small, it will probably increase.

Present Distribution of Gold Mining in the United States

The final result of the exploration for gold in the United States since 1800 is that the metal has been found in large quantities along the Pacific Coast from California to Alaska, also in the Great Basin region east of the Sierra Nevada, in the Rocky Mountains and in that eastern outlier of the Rocky Mountains known as the Black Hills; it has been found in much smaller quantities in the Appalachian region of the eastern states, and sporadically elsewhere in the region lying between the Appalachian and Rocky Mountains. Among the latter instances may be mentioned the Ropes mine in Michigan, where a gold-bearing vein was worked for a number of years, and many other places where a little gold has been obtained, but not enough to cut any important figure in the general production of the country.

At the present time the chief gold-producing regions in the United States are California, Nevada, Colorado, Alaska, South Dakota, Utah, Montana, Arizona and Idaho, while the first four produce by far the larger part of the American output.

Events Influencing Gold Discoveries in the United States

Several important events in the history of the United States have done much to stimulate the search for gold. In California the declaration of freedom from Mexico about a year and a half before the discov-

ery of gold, brought many adventurous people there who did much to develop the gold resources when found; in fact, the very discovery of gold was made in the building of a mill to supply the wants of the increasing population of California.

After our Civil War had ended, in 1865, many men who had served in both armies had become too much accustomed to constant excitement and action to settle down to the ordinary monotonous callings of life, and thousands of them started for the west as a country offering the life of adventure that they sought. Such men were thrifty, intelligent, brave and used to hardships. No pioneers of a new country were ever more suited to their task than they, and the result was soon seen in many new mining discoveries, made in the years immediately following the war.

Again, after the price of silver began to fall, many men were thrown out of work by the closing of the mines, and the search for gold attracted them as offering a more stable pursuit; with the result that in the years from 1890 to 1905 some of the great gold discoveries of the world were made, including the Cripple Creek, Klondike, Goldfield and other regions.

Financial panics and times of business depression have also marked epochs in the development of mining, especially gold mining. When manufacturing and other commercial pursuits are not prosperous, when men are thrown out of work, speculators financially ruined, banks closed and the whole world seems gloomy, then gold mining has often been most prosperous; for the unemployed and the unfortunate have taken to it as a means of earning a livelihood or of recuperating their shattered fortunes, and in doing so have often made rich discoveries. Many of the pioneers who came to Colorado in the 1859 rush were men who had suffered in the financial panic of 1857; and many of the early prospectors in the Cripple Creek region were people who had been similarly injured in the panic of 1893, while many a Klondike explorer had been a prosperous business man before the latter sad era. In the same way a marked increase in the production of gold in 1908 followed the financial panic of 1907. This feature of gold mining as a last help to the unfortunate has been observed not only in the United States, but in many other parts of the world. When all else fails, the people take to gold mining, especially placer mining, which requires but little equipment, is easily learned, and in some places is sure to afford a certain, though often meager, profit.

An important factor in the progress of gold mining has been the increased respect for the industry on the part of the public at large. Not many years ago, many people, especially in the east, looked on gold mining as a gamble and a calling of questionable character; and the numerous fraudulent schemes that had been floated gave them some

justification for their ideas. Many a person who sought to increase his fortune by mining, kept the matter a secret, so as not to injure his standing with his more conservative business associates. Since then, however, people have realized that there is good as well as bad in gold mining, as in every other business, and the credit of the industry has improved greatly, so that more and more interest is being taken in it.

Production of Gold in the United States[6]

The production of gold in the United States up to 1834 has been estimated at $14,000,000,[7] all of it from the southern states. In 1834 the annual production was about $1,000,000, and in 1853 the discoveries in California had increased it to about $65,000,000. Later, the exhaustion of some of the California mines caused the production of the United States to fall off, until, with various fluctuations, it sank to $31,801,000 in 1885. Since then the renewed interest in gold mining has increased the production. In 1895 it had risen to $46,610,000, and in 1905 it was $88,180,700, while in 1909 it reached $99,673,400, an annual production not known to have been exceeded to that time by any country except the Transvaal.

The total production of the United States in gold, since that metal was first mined in this country, in the early part of the last century, up to the end of 1909, has been $3,165,304,400.[8] When it is remembered that most of this immense sum has been produced since 1848, some idea can be had of its vast effect on the political and economic conditions, not only of the United States but of the world.

Future of Gold Mining in the United States

It is difficult to make accurate predictions about the future of any mining industry except from the mines already known, and even then such predictions are liable to grave error. The difficulty, however, becomes still greater when we discuss the possibility of the discovery of new mines, and this is especially true in the United States, where there are wide regions in which new mines might be found, but where no one can yet say that they do exist.

A striking feature of past experience is the fact that many of the greatest gold discoveries in the United States were made in regions that were already well known, and in some cases had been passed over

[6] Space does not permit giving here detailed figures of the production of gold in different parts of the United States, and only enough statistics are given to make the present paper intelligible. Fuller statistics are easily obtained in the Reports of the Director of the Mint, the "Mineral Resources of the United States" and the "Mineral Industry."

[7] Annual Report, Director of the Mint, 1910.

[8] Annual Report, Director of the Mint, 1910.

time and again by prospectors. The gold of the southern states was found in parts of the country that were well settled by an agricultural population, and yet for a long time it excited no attention. In this case the fact that the people had had no experience in gold mining was doubtless sufficient reason for this neglect; but when we see similar cases in the west, where mining has been the chief occupation of the people since the country was settled, the fact becomes more noteworthy.

The gold of California was discovered purely by accident, in a country which, though not exactly well known, had yet been passed over by many people, and was at least well enough known to warrant the existence of a mill, in the construction of which the gold was found. The Cripple Creek district was discovered in one of the best known parts of Colorado, in a region that had for many years been settled by ranchers. Year by year the cowboys and others, among them many miners, had passed over it without noticing the ore, and yet the latter was lying in lumps on the ground or protruding in outcrops in a way that made it a prominent feature of the neighborhood. Goldfield in Nevada was also discovered in a region that was well known to prospectors, and the ore occurred in large prominent outcrops, yet it lay for years ignored. The gold gravels of the Klondike had been trodden over by Hudson Bay trappers and the early miners of the Yukon for years before they were discovered.

Many other similar cases might be mentioned of new discoveries in well-known regions, where the gold was at last found by some inquisitive prospector having an assay made of a piece of strange-looking rock, which every one else had always seen but never thought of value, or by sinking a well for water, digging a ditch, planting a tree, or in walking over a place where the forest had recently been burned. The long delay in many of these belated discoveries was due to the ignorance of the prospector who could recognize certain ores but not others, while the general neglect of gold mining and the craze for silver mining in parts of the west for thirty years, from 1860 to 1890, was doubtless a contributing cause.

The fact remains, however, that the three greatest gold regions discovered in recent years, that is, the Cripple Creek, Klondike and Goldfield districts, were all found in well-known localities; and the question naturally arises, may not many other discoveries be made not only in the less explored parts of the west, but even in the shadow of the towns and ranches? One can not refrain from the conclusion that this is not only possible, but probable. Moreover, the better knowledge of the nature and occurrence of ores, which the prospector of to-day is gradually acquiring, will greatly assist in the search.

Aside from the possibility of new discoveries of gold, the improved metallurgical methods, the cheaper fuel, transportation facilities and

other conditions are constantly enabling the gold miner to treat ores of lower and lower grade. Ores that were once considered of too low grade to be of value are now treated at a large profit, and many a mine abandoned years ago as worked out has been reopened and has become very profitable; while the old waste dumps have been sorted over for ore that was thrown away as worthless in the early days.

In placer mining the same progress has taken place. The early work by hand with pans and cradles was replaced by sluices, then these by hydraulic machinery and sluices, while later the system of dredging the gravel was introduced. Each method marked a step in the economical evolution of gravel mining, and to-day in many parts of the west gravels are being worked which have already been handled several times over by older methods.

An important amount of gold comes as a by-product from the treatment of copper and lead ores, and to some extent zinc, iron and other ores, and as the amount of base metals mined is constantly increasing, the gold from this source will also probably increase.

When we consider the probability of new gold discoveries in the United States, the longer life of known mines under improved conditions, the increased production as a by-product from the base metals, the future of gold in the United States seems bright. For a long time to come the present production of approximately $100,000,000 yearly should easily be maintained and there is a strong probability that it may in time be greatly exceeded.

MODERN TENEMENT HOUSES

By JONATHAN A. RAWSON, Jr.
NEW YORK CITY

THERE are now being completed in New York City two groups of tenement buildings, which without doubt embody more real improvements in tenement house construction than have ever before been seen in any one structure. Both groups are on East 77th Street near the East River. One is being erected by Mrs. William K. Vanderbilt, Sr., and the other by the Open Stair Tenement Co. Henry Atterbury Smith is the architect in each case and similar buildings after his designs are soon to be erected in Hoboken and further downtown in New York, in West 47th Street.

Whether science, learning or practical common sense has contributed more to the latest improvements in tenement-house construction as revealed in these buildings, it would be hard to say, but whichever it is Mr. Smith deserves the credit. He has given many years to the study of this problem and it was some time after he worked out its solution before he was able to persuade capital to adopt his plans. All of

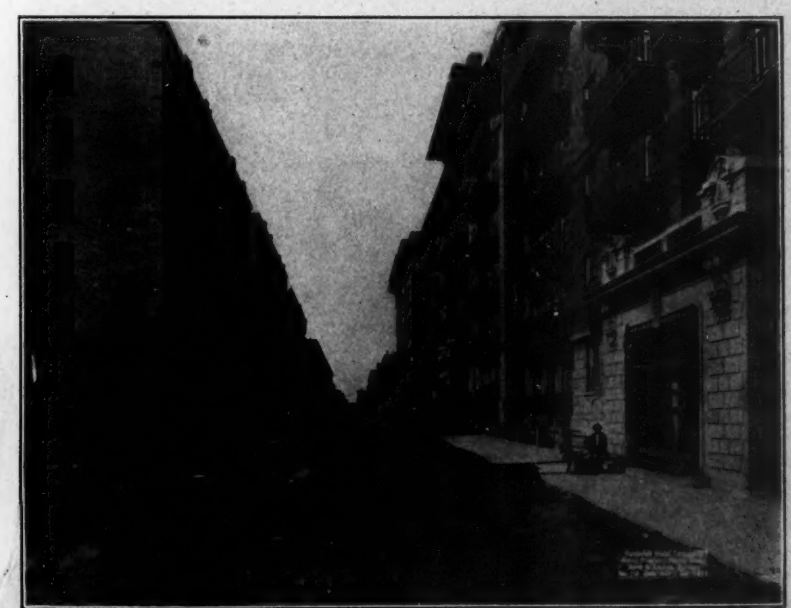


FIG. 1. EAST 77TH STREET, NEW YORK, LOOKING WEST. Vanderbilt Tenements on the right, and those of the Open Stair Tenement Company on the left.

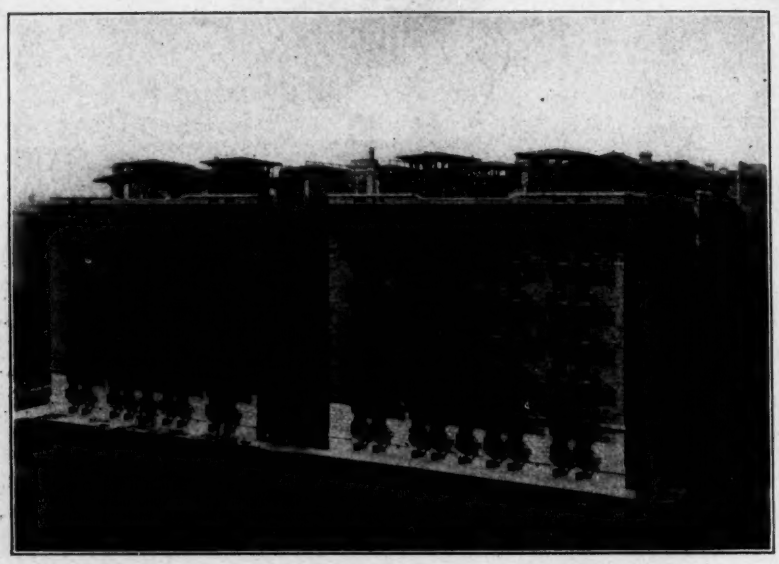


FIG. 2. THE VANDERBILT TENEMENTS.

that is now of the past, however, and the first of his buildings is now nearly ready for occupancy.

Mr. Smith's chief aim and purpose in the construction and arrangement of his buildings is to secure for them the greatest possible supply of fresh air and sunshine, and conversely to eliminate every opportunity for darkness and bad ventilation. Instead of erecting one immense structure broken only by the narrow shafts and congested yards of most tenement houses, he makes each building a group of four units, each surrounding a spacious central court. This court is entered through a direct, unobstructed passage from the street. One of these entrances is seen at the right of Fig. 1. From the central court there are recessed stairways in each corner extending all the way to the roof, and with private entrances directly into each apartment.

These are the open stairs which form the distinguishing characteristic of all the tenement houses designed by Mr. Smith. The primary purpose of these open stairs is to do away with all interior passages and hallways and to provide each family with its own entrance from outside the building. The open stairs are in reality open on one side only as shown in Fig. 3, which gives not only a view of the interior of one stair well, but also a view of the well in the opposite corner of the court as seen from outside. Every particle of material in the stairway is fireproof and hardly a crack or a crevice is left in which dust or dirt may collect. The railings are of iron, and midway between the floors are iron seats to serve as resting places. To keep out rain and snow there are hoods over these seats, projecting outward at the proper angle to

accomplish their main purpose without excluding air or light. Smooth glazed white tile on the walls of the well and large panes of thick glass in the hoods are designed to catch and reflect every available ray of light. There is nothing dark or dingy about such a stairway and its advantages over the foul-smelling, unsanitary halls of the average tenement are too apparent to require enumeration.

The top of each stair well is covered with a pergola like that shown in Fig. 4. The pergolas have iron framework holding glass panels over the top and glass windows part way up the sides, with numerous sections which can be opened when desired. Immediately under its roof the pergola is always open for ventilating purposes, but so that neither snow nor rain can find its way into the hall.

Another feature of the open stairs hardly less interesting than those already mentioned is their intensely practical usefulness in case of fire. It is a remarkable testimonial to their value in this respect that the city officials who pass on such matters have decided that no fire-escapes are required on tenements of the open stair type. The most practical fire proof quality of the open stairs is that they are the one means of leav-

FIG. 3. THE OPEN STAIRS, with outlook beyond, across the central court and into the stair well of the opposite corner.

ing the building with which the tenants are always familiar—the exits towards which they would naturally hasten in case of danger, and further that they allow of escape either in two directions—to the ground in the central court or upward to the roof whence the tenant may cross to another well and then descend. Beginning with the fact that the building itself furnishes almost nothing for flames to feed upon, and then noting that two routes to safety are always available and that no tenant is ever shut off from a direct avenue of escape unless the fire is actually at his own threshold, where there is not enough for it to burn to assume dangerous proportions, and the case for the open stairs as effective

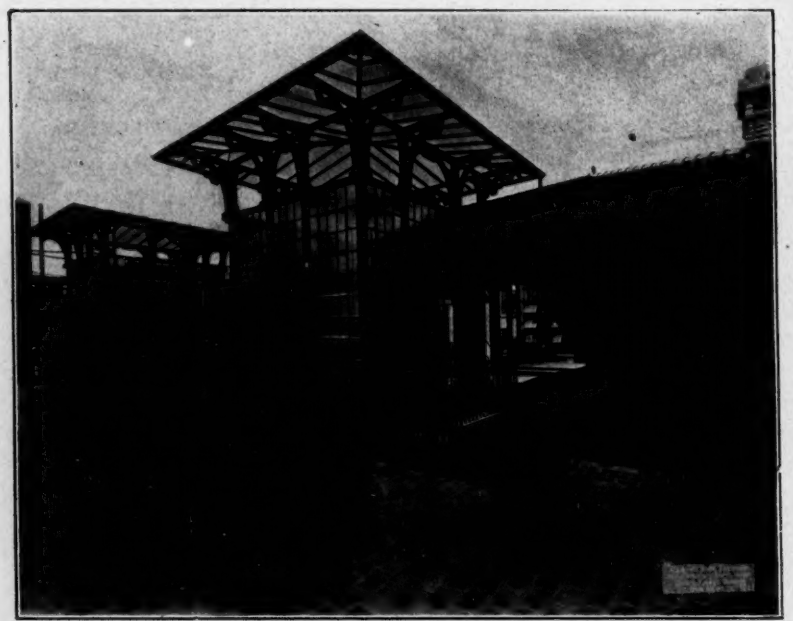


FIG. 4. ON ROOF OF THE VANDERBILT TENEMENTS. The pergola in the center covers one of the open stair wells, and at its right is a covered shelter for the use of tenants.

preventives of fire or escape therefrom is rather strongly established. No fire could gain much headway in any part of a building of this sort without soon being detected and located, and prevented from spreading by playing hose from the central court upon the entrance of the burning apartment.

What the architect might designate as the fenestration of the periphery, but would be more easily recognized by the layman as the window treatment of the exterior, is another vital feature of the plan to secure the utmost circulation of air. In the Vanderbilt group as seen in Fig. 2 all exterior windows are extremely high, extending from floor to ceiling, and have sashes in three sections so that two thirds of the

FIG. 5. A KITCHEN IN THE VANDERBILT TENEMENTS, showing cement flooring with unbroken, curved joining of floor and walls; also the triple-hung windows.

window may be thrown open. Moreover, each apartment has a strong, spacious iron balcony reached through the windows. These balconies have no communication with each other and are sufficiently wide to be used as sleeping porches if desired. The arrangement of the rooms is such that no outside widows open on toilets or hallways. All of them are either in kitchens or bedrooms and in a great majority of the apartments there is a direct cross draught through the rooms, from the street side to the inner court, or from the courts separating the various units.

Both the roofs and the cellars of the Vanderbilt buildings are in a

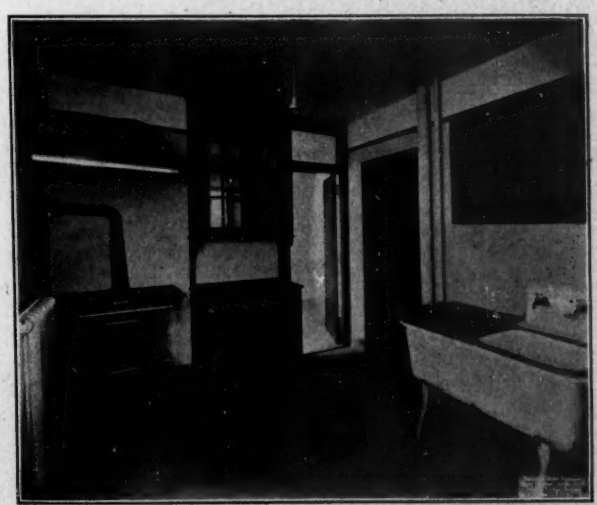


FIG. 6. ANOTHER VIEW OF A KITCHEN, showing hood over the gas range.

sense the common property of all tenants. In the basements are laundries for the use of tenants who prefer not to do their washing in their own rooms, and the roofs provide ample space where children may play or for older folks to rest or do their light housework in the open air.

Within the tenements, all the woodwork and structural furnishings are planned in the simplest possible way. There is no attempt at ornamentation, but everything is done to further the effort to secure cleanliness and wholesomeness. The floors are of concrete monolythic construction, or all of one solid surface and they have the sanitary base which means that they round up gradually into the walls with no sharp joints or corners.

The buildings are lighted throughout with electricity, but there are gas ranges for cooking over which are wide metal hoods which carry the odors and vapors from the stove into a flue which runs up into a pipe extending high above the floor of the roof. Sanitary earthenware is used in the bath rooms and for the set-tubs in the kitchens.

THE HISTORY OF GYMNOSPERMS

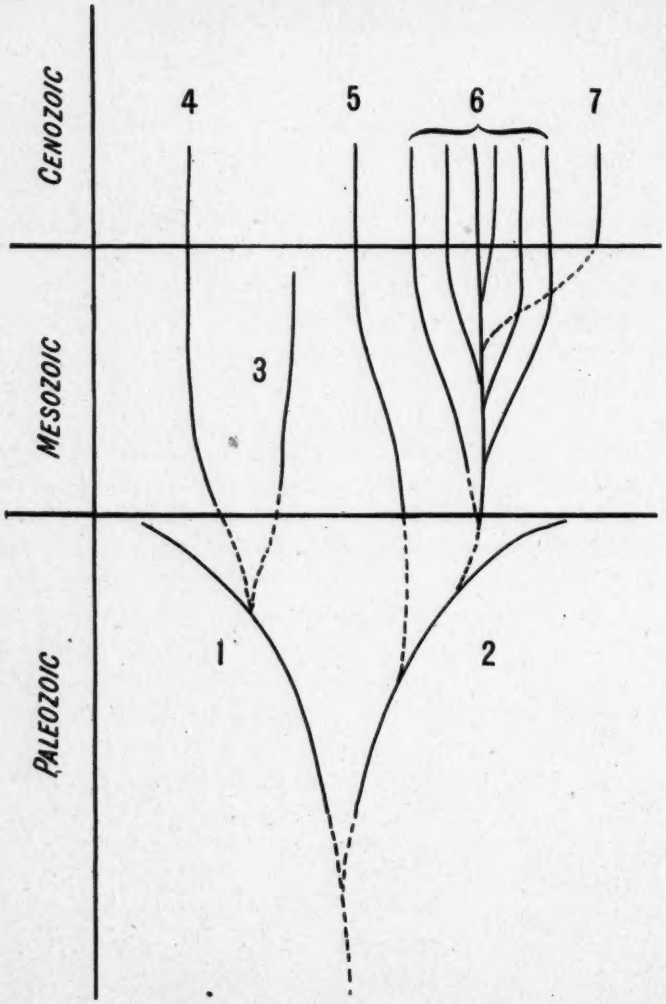
By Professor JOHN M. COULTER
UNIVERSITY OF CHICAGO

NO great group of plants seems to have left so continuous and full a record of itself, through so long a stretch of time, as have the Gymnosperms. Further work may uncover equally extensive records of certain other vascular groups, but our knowledge of the history of Gymnosperms is at present more complete than that of any other group of plants.

Several things have contributed to the completeness of this knowledge of Gymnosperms. They have always been abundant in the flora of every period that has left a plant record, and they are still abundant. This has given continuity and wealth of material throughout the whole history of vegetation, so far as that history is known. Those who picture an historical succession of the great plant groups are not representing the records in sight, for our earliest records show a vegetation as varied and complex as that of to-day, so far as the great groups are concerned. Although Angiosperms are probably relatively modern, seed-plants were represented early in the Paleozoic by Gymnosperms. This means that the evolution of the plant kingdom, in all its essential outlines, had been attained at least as early as any known records of vegetation.

Another fact which has contributed to the completeness of our knowledge of the group is what may be called the renascence of paleobotany as a morphological subject. Not only did this involve the comparative study, from sections, of the essential structures, but also it enormously extended the range of structures used in indicating relationships, by including the vascular system in the evolutionary scheme. The incorporation of vascular anatomy into modern morphology was significant not merely because it supplied another line of attack, but also because it deals with the most completely recorded structure of vascular plants and really gives continuity to the paleobotanical record.

The Gymnosperms were represented during the Paleozoic by two great groups, Cycadofilicales and Cordaitales. They were not merely members of the Paleozoic flora, but they were conspicuous members, together constituting the seed-plant vegetation. Neither of these groups has been traced with certainty into the Mesozoic, so that even though a few lingering forms may be found at a later period, they are essentially restricted to the Paleozoic, and our knowledge of them has been derived



HISTORICAL CONNECTIONS OF THE GROUPS OF GYMNOSPERMS: 1, Cycadofilicales; 2, Cordaitales; 3, Bennettitales; 4, Cycadales; 5, Ginkgoales; 6, Coniferales; 7, Gnetales.

chiefly from material obtained from the Coal-measures. Although the two groups are equally ancient, so far as our records go, having been recognized well into the Middle Devonian, it is quite evident from comparative structures that the Cycadofilicales are the more primitive, and presumably the more ancient. Whether they are actually the most ancient seed plants or not, they are at least the most primitive seed plants of which we have any knowledge.

The presence of this great group of primitive seed plants (Cycadofilicales) in the Paleozoic was obscured for many years by the impression that they were ferns. A very large percentage of the Coal-measure

vegetation consisted of these fern-like plants, and so the coal period was pictured as a time of luxuriant fern vegetation, rivalling our present tropics in that feature. Approximately ten years ago these fern-like plants were observed to bear seeds, and the Cycadofilicales became established as the most fern-like group of Gymnosperms. All of the great Paleozoic "fern" groups were found involved in the seed-bearing habit, until now the residuum of real ferns in the Paleozoic seems to be quite small. In any event, it has been made clear that the Cycadofilicales were derived from ferns; and if so, probably all the other Gymnosperms. It should be understood that the ordinary ferns of to-day are relatively modern, and are quite unlike those very ancient ferns which gave rise to the Cycadofilicales, and which have received the general name Primofilices.

This ancient group of Gymnosperms resembled ferns in every important particular except in the seed-bearing habit. Whereas in ordinary ferns the sporangia are borne in groups or so-called "fruit dots" (sori) on the fronds, in Cycadofilicales some of the sori were replaced by seeds, which makes a seed the morphological equivalent of a sporangium or a group of sporangia (a sorus). The bearing of seeds necessitated also the presence of structures corresponding to stamens, and producing pollen. These pollen-bearing structures remained like the fern sporangia (in sori), and for a long time confirmed the notion that these fern-like plants were really ferns. To say that a fern-like leaf must belong to a fern might be unsafe, but to say that such a leaf bearing sporangia in sori must belong to a fern seemed absolutely safe. And still many of these "fern sporangia" have turned out to be the pollen sacs of seed plants.

If the bearing of seeds distinguished Cycadofilicales from ferns, the absence of cones distinguished them from other Gymnosperms. The seeds and pollen sacs were borne as freely on the fronds as are the sporangia on the fronds of ferns. In the later groups of Gymnosperms, the seed-bearing leaves and pollen sac-bearing leaves (both kinds called "sporophylls") became distinct from the ordinary foliage leaves, and were finally compactly organized into the cone-like structure (strobilus) characteristic of most Gymnosperms. But among the Cycadofilicales the strobilus stage was not reached.

The Cycadofilicales seem to have given rise to two great branches of Gymnosperms, both of which are represented in the present flora. One of them includes the Cycads, and therefore have been called the Cycadophytes; the other includes the Conifers, and therefore may be called the Coniferophytes. The Coniferophytes differentiated from the Cycadofilicales earlier than our records of vascular vegetation, for the Paleozoic representative (Cordaitales) of Coniferophytes is distinct from the Cycadofilicales as far back as records go. On the other hand,

the Cycadophyte branch is not distinguishable until the Mesozoic.

Historically, therefore, the Cordaitales must be considered as the second group of Gymnosperms. Their connection with an ancient fern stock is evident in their structure, but they have lost many of the fern characters that were retained by Cycadofilicales. The fact that Cordaitales are much further from ferns than are the Cycadofilicales is perhaps the best proof that they have come from the ferns by way of the Cycadofilicales. The combination of changes involved in their structure is all in the direction of the later Conifers, as, for example, the branching stem (constituting what is called "the habit") with its thick cylinder of secondary wood, the narrow and entire leaves, and the cones (strobili). It would not fit the purpose of this presentation to include the changes in the more intimate structures, since their nature and significance can be appreciated only by the special students of the group, but they are just as striking as the more obvious changes mentioned.

The Gymnosperm vegetation of the Paleozoic, therefore, comprised two great genetic groups: the Cycadofilicales, representing the primitive Gymnosperm stock that differentiated from the ferns; and the Cordaitales, representing the primitive Coniferophyte stock that differentiated from Cycadofilicales more ancient than those we know.

In the Mesozoic flora the Gymnosperms were represented by four great groups, evidently derived from the two Paleozoic groups. As stated above, the Cycadophyte branch became distinct, and for a long time all of its representatives were thought to be Cycads. For this reason, the Mesozoic has been called the "age of Cycads," so far as the vegetation is concerned. It is one of the triumphs of American paleobotany that it has put on a firm basis our knowledge of the great Cycadophyte group of the Mesozoic, and has shown that it is quite different from the modern Cycads. The group is called Bennettitales, and although a few forms from foreign localities have been known for a long time, it remained for Mesozoic deposits of the United States and Mexico to reveal a remarkably rich display of forms in admirable preservation. The investigation of this material has been carried on chiefly by Dr. G. R. Wieland of the Yale Museum.

The Bennettitales, therefore, are the so-called "fossil Cycads" of the Mesozoic. So far as the records show, they are restricted to the Mesozoic, so that they represent an extinct Mesozoic group, just as there are two extinct Paleozoic groups. Of course it is not only conceivable, but also probable that the Paleozoic Cycadofilicales, from which Bennettitales were derived, continued into early Mesozoic; and that the Mesozoic Bennettitales began to differentiate in late Paleozoic. The external appearance of Bennettitales justifies their early assignment to the Cycads, for the whole habit is Cycadean. The stems are either tuberous or cylindrical, and crowned by a rosette of large, fern-like

leaves, giving to the cylindrical forms the appearance of tree ferns. The remarkable feature of Bennettitales, however, is the cone (strobilus), whose structure is unique among Gymnosperms. These cones, instead of being solitary and terminal, in the midst of the rosette of leaves, as in most Cycads, are lateral on dwarf branches which arise in profusion from the stem. But this is a small feature as compared with the fact that the cone is "bisporangiate." In other Gymnosperms the ovules (and of course seeds) and stamens are in different cones, and often these cones are on different plants. In Bennettitales, the rosette of stamens, which resemble small fern fronds bearing sporangia, subtends the more or less extended axis-bearing ovules, and both stamens and ovules are encased by enveloping bracts. This bisporangiate character, and the relation of stamens to ovules in the cone, are so suggestive of such an Angiosperm flower as that of magnolia that some botanists would see in Bennettitales the ancestral forms of Angiosperms. It is certainly true that the Bennettitales were abundant and wide-spread during the Mesozoic, and it seems to be true that the Angiosperms originated during the Mesozoic.

The Cycads (Cycadales) constitute a second group of Mesozoic Gymnosperms, associated with the Bennettitales of common origin, but apparently not a conspicuous part of the vegetation. It is very likely true that Bennettitales and Cycadales represent two independent Mesozoic derivatives from the Paleozoic Cycadofilicales; that the Bennettitales attained a dominant place in the Mesozoic flora; and that the Cycadales, much less conspicuous during the Mesozoic, persisted until the present day as the only living representatives of the Cycadophytes.

The Cycadophyte line is characterized by the retention of many of the fern-like features of the Cycadofilicales. In habit, in foliage, in stem structure, in sporangia, in reproductive habits, the features of Cycadofilicales were continued; so that the living Cycads, although relatively modern from the standpoint of history, are structurally the most primitive of living Gymnosperms, because they most resemble the historically ancient Cycadofilicales.

The two other groups of Mesozoic Gymnosperms were derived from the Paleozoic Cordaitales, the Paleozoic member of the Coniferophyte branch. They are known as Ginkgoales and Coniferales, the former being nearly or quite extinct to-day, and the latter comprising the present conspicuous Gymnosperm vegetation of the temperate regions.

The Ginkgoales were abundant during the Mesozoic, but apparently remained quite constant in characters, so that they can be represented structurally by a single line extending from the late Paleozoic to the present time. They are really a Mesozoic type, and their single representative in the present flora has probably continued to exist simply because it is a tree kept in cultivation in the temple grounds of China

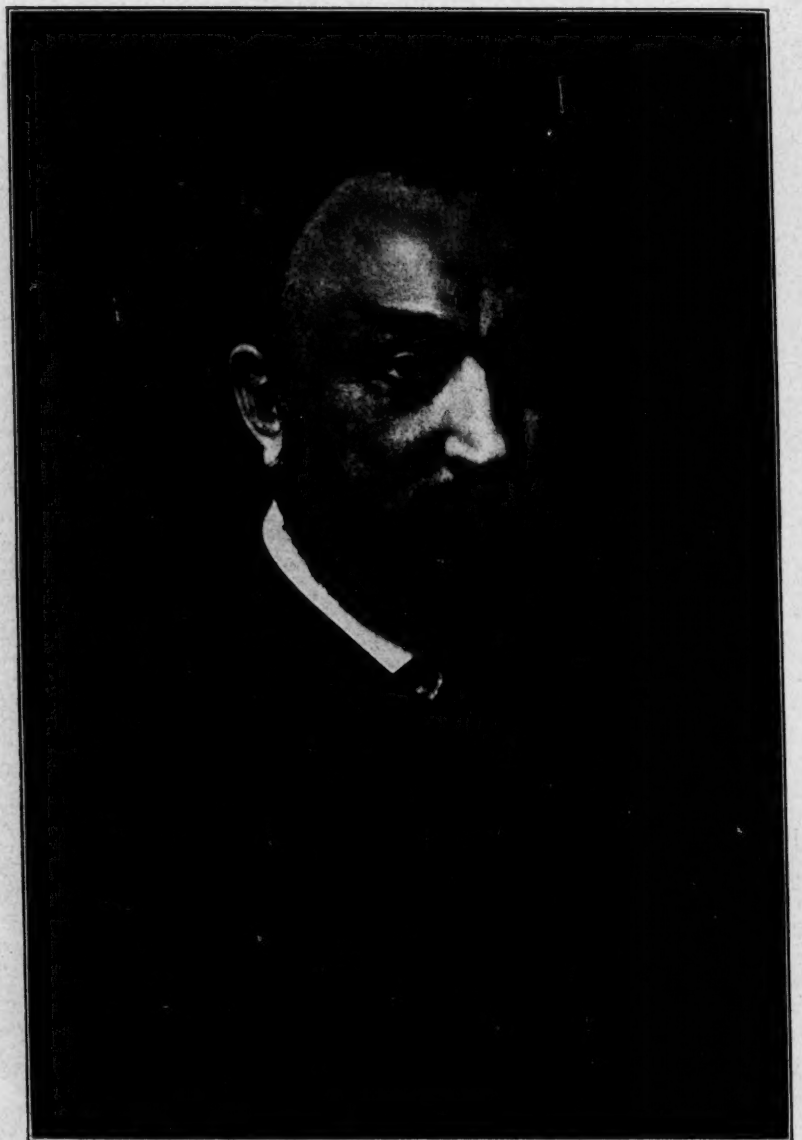
and Japan. Of course Ginkgoales continued all the features of Cordaitales that looked towards Conifers, such as the branching habit, relatively simple leaves, and thick vascular cylinder. The monosporangiate cones were also continued, but the most notable feature is the continuation of the swimming sperms of Cordaitales. Cordaitales had continued the swimming sperms of Cycadofilicales and ferns; in fact all the vascular plants of the Paleozoic had swimming sperms. One of the most primitive features of the Cycadophyte branch is that it retained throughout this primitive, fern type of male cell. In the present Gymnosperm flora, therefore, Cycads and Ginkgos are distinguished by having swimming sperms, the former having continued them directly from the Cycadofilicales, the latter obtaining them indirectly from the same source, and directly through the Cordaitales. To state the situation in other terms, it may be said that the Cycads have continued primitive vegetative and reproductive structures, while the Ginkgos have retained primitive reproductive structures and have changed the vegetative structures, a change initiated by the Cordaitales.

All of this serves to emphasize the position of the Coniferales, the fourth Mesozoic group, and the dominant Gymnosperm group to-day. It not only continued to change the vegetative structures, but it also abandoned the primitive features of reproduction in abandoning the swimming sperm, which became a relatively passive cell conducted to the egg by a pollen tube. Few persons realize that Gymnosperms in general, in terms of great groups, have swimming sperms, which the pollen tubes do not conduct; for this situation is overshadowed by the fact that the single overwhelming group of Gymnosperms to-day has passive sperms conducted by pollen tubes.

In connection with this change of reproductive habit, the Coniferales during the Mesozoic differentiated into the six great families or tribes recognized to-day, so that it is the one great group of Gymnosperms that developed an extensive range of forms. The historical interest connected with Conifers, therefore, is not so much the origin of the group as a whole, for that seems to be traced clearly to the Paleozoic Cordaitales, as the origin and relative antiquity of its tribes. This question has been answered by the study of vascular anatomy, chiefly by Jeffrey of Harvard, supported by the morphology of the reproductive structures, and by history. The conclusion is that the tribe containing the pines is to be regarded as including the modern representatives of the most ancient Conifers. The only possible contestant for this honor is the tribe comprising the araucarians of the southern hemisphere. The four other tribes (podocarps, taxads, taxodiums and cypresses) are clearly relatively modern. The general conclusion, therefore, is that the Conifer stock became differentiated from the Cordaitales with features characteristic of the pine tribe, and that from this

primitive stock the other tribes separated later, and the pine tribe itself became more modern.

The history of Gymnosperms is not complete without mention of its seventh great group, the Gnetales. They comprise three genera, extremely unlike in habit, habitat and geographical distribution, but held together by certain important characters. They are so different from other Gymnosperms that no phylogenetic connection is clear, and there is no sure record of them as fossils. This seems to indicate that they are very modern, but their dissimilarity and their wide separation from one another geographically make it certain that if they are genetically related they must have a history that remains to be discovered. Such suggestions of connection as can be obtained indicate as a possibility that Gnetales are derivatives from the prolific Coniferales stock.



DR. EDWARD C. PICKERING,
Director of the Harvard College Observatory, President-elect of the American Association for the Advancement of Science.

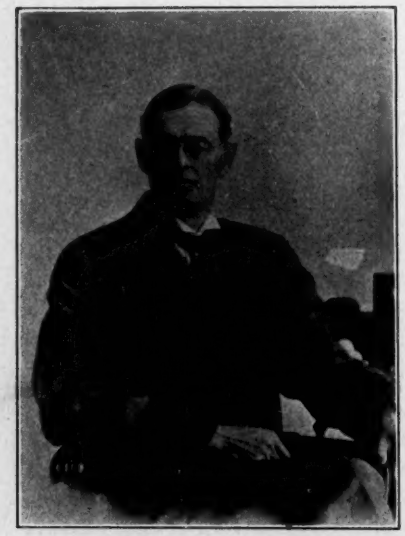
THE PROGRESS OF SCIENCE

THE WASHINGTON MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE American Association for the Advancement of Science and the societies affiliated with it held an unusually successful meeting in Washington during Christmas week. This, the sixty-third meeting of the association, was the largest in its history, the registration of its members being 1,306. There is no practical advantage in registering and at Washington the places of meeting were so widely scattered that many members failed to register. The secretary of the council estimates the total attendance of members of the association and of affiliated societies at 2,800.

The association had the privilege of being welcomed to the capital of the nation by its president, who in his address exhibited an appreciative interest in the scientific work done under the government and in the investigations of scientific men. He said that if he had the power he would place an astronomer at the head of the U. S. Naval Observatory. President Taft must have paid what he regarded as a high compliment to the work of a scientific man when he compared it with that of a judge. Indeed he placed the work of the bench even higher than might have been expected, for he said that it is the duty of a judge to find a final solution in accordance with "eternal justice," whereas it is commonly supposed that a judge must interpret temporary laws. Dr. Charles E. Bessey, head of the department of botany at the University of Nebraska, president of the association, in reply to the address of welcome, called attention to the fact that scientific men are like those who occupy legislative, judicial and executive positions, in that they work for the good of the community rather than for their own advancement; but whereas the politician works only in the present and for the present, the scientific man, like the statesman, must look before and after. Dr. Bessey also called attention to the need of giving scientific men in the Washington bureaus the opportunities most favorable to scientific research. The annual address was then delivered by President A. A. Michelson, head of the department of physics in the University of Chicago, whose subject was "Recent Progress in Spectroscopic Methods." Dr. Michelson traced with such clearness as to hold the complete attention of the audience the important researches in which he himself has taken such a leading part.

It is quite out of the question to describe the work of the eleven sections of the association and of the thirty special societies which met at Washington. The titles of the papers presented would fill a considerable part of an issue of the MONTHLY, and the papers themselves would fill its volumes for years to come. The addresses of the president and of the vice-presidents have been printed in SCIENCE, where also will be found accounts of the proceedings of the association and of the various societies and some of the addresses and discussions presented before them. Here we can only call attention to the wide scope and great quantity of research work being carried forward in this country and adequately represented at the Washington meeting. The only drawback to our satisfaction is that there appear to be no advances or discoveries of such outstanding importance as to deserve special recognition.

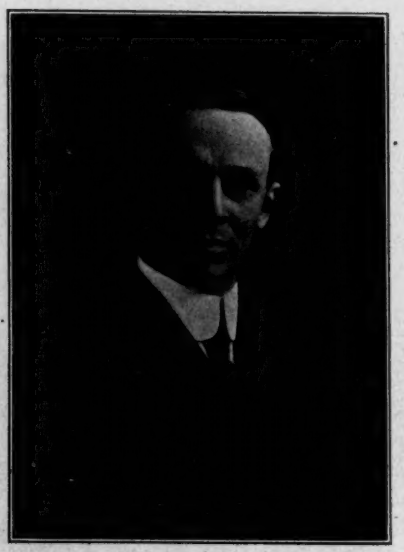


DR. EDWIN B. FROST,
Director of the Yerkes Observatory,
Vice-president for Mathematics
and Astronomy.

NEW UNIVERSITY PRESIDENTS

THERE is no decline in the birth rate of university presidents. Within a few months President Vincent has been installed at the University of Minnesota, President Brown at New York University, President Murlin at Boston University, President Hodges at the University of West Virginia, President Benton at the University of Vermont and President Bowman at the State University of Iowa. The deadlock at Princeton University has been broken by the election of Dr. John Grier Hibben, Stuart professor of logic, after the offer of the position had been declined

DR. CHAS. S. HOWE,
President of the Case School of Applied
Science, Vice-president for Mechanical
Science and Engineering.

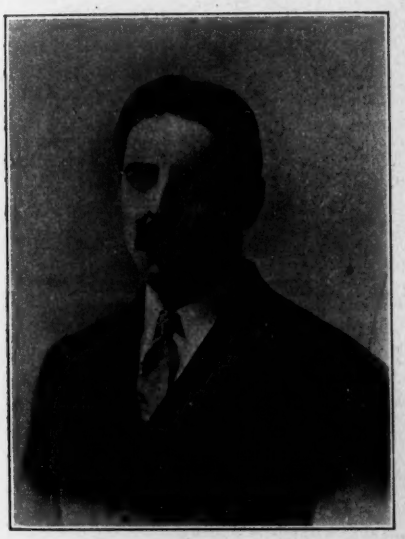


DR. ROBERT A. MILLIKAN,
Associate Professor of Physics at the
University of Chicago, Vice-
president for Physics.

by Dr. J. M. T. Finney, the Baltimore surgeon. It seems that any one who has attended one of these functions of installation, where many presidents gather on the stage, must have noticed the diversity of type, the scholar and the politician, the man of science and the promoter, the hereditary gentleman and the climber, all being in evidence. A gift for oratory seems to be almost the only common trait and even here the variety is more noticeable than the similarity.

One may wonder what trait or ac-

cident has given these gentlemen the extraordinary position they hold in higher education and in the community. In *The Educational Review*, for November, President Eliot, whose ability, persistence, personality and long tenure of office have been important factors in developing the autocracy of the presidential office in the university and its function as general adviser on all subjects in the community, writes pleasantly about "The University President in the American Common-



DR. EDWARD L. THORNDIKE,
Professor of Genetic Psychology at Teachers College, Columbia University, Vice-president for Education.

wealth." He says: "Most American professors of good quality would regard the imposition of duties concerning the selection of professors and other teachers, the election of the president, and the annual arrangement of the budget of the institution as a serious reduction in the attractiveness of the scholar's life and the professorial career." The question arises how one who knows so little about the thoughts of professors can adequately fulfill the paternal function, and whether the kind of persons the president thinks the pro-

DR. GEORGE T. LADD,
Emeritus Professor of Philosophy at Yale University, Vice-president for Anthropology and Psychology.

DR. J. PEASE NORTON,
Yale University, Vice-president for Social and Economic Science.

fessors ought to be will provide presidents for the future. And if there were no university presidents, what would become of the nation?

SCIENTIFIC ITEMS

WE record with regret the deaths of Major Clarence Edward Dutton, U.S.A., retired, eminent for his contributions on volcanoes and earthquakes; of Miss Susan Maria Hallowell, professor emeritus of botany in Wellesley College; of Mr. George R. M. Murray, F.R.S., for many years on the staff of the department of botany of the British Museum, and of M. Paul Topinard, the distinguished French anthropologist.

PRESIDENT TAFT has nominated Dr. Rupert Blue, of South Carolina, as surgeon general of the public health and marine hospital service.—M. Henri Bergson, professor of philosophy at the Collège de France, has been appointed visiting French professor of Columbia University for the year 1913. M. Bergson has also been appointed Gifford lecturer at Edinburgh.—The Academy of Natural Sciences of Philadelphia has awarded the Hayden Medal in gold for distinguished work in geology to Professor John C. Branner, of Leland Stanford Jr. University.

THE organ of the Japan Peace Society gives an account of the visit of Dr. David Starr Jordan, president of Stanford University, in August, September and October, undertaken under the auspices of the Japan and American Peace Societies. Dr. Jordan gave a large number of addresses, mainly on peace and arbitration, at Tokyo, Yokohama, Sendai, Nagoya, Okayama and Osaka. At Tokyo between September 13 and 18 he gave as many as ten formal addresses.